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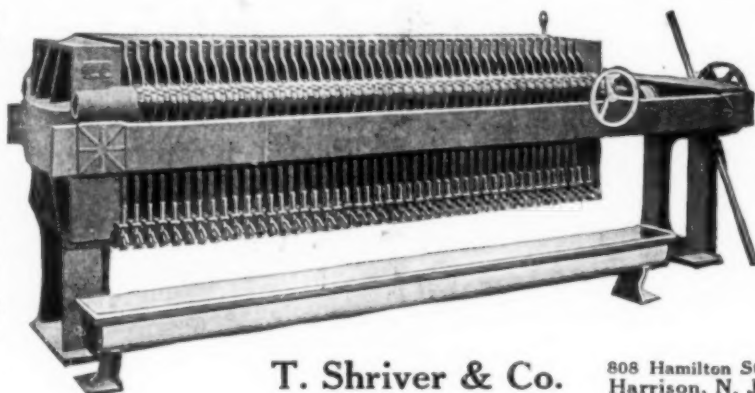
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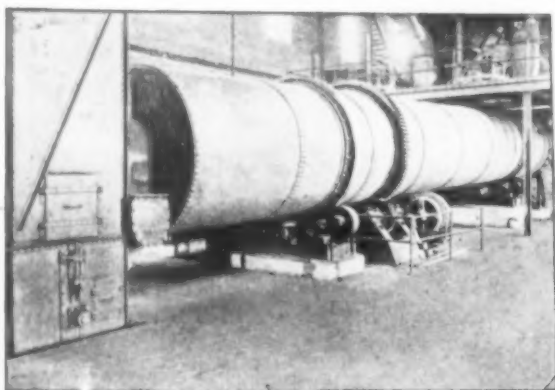
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# CHEMICAL & METALLURGICAL ENGINEERING

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## Choosing a Director For the Bureau of Mines

**D**ESPITE the limitations of its name, the United States Bureau of Mines has a very definite and practical interest for the chemical and metallurgical industries. Mines belie their name unless they yield ores, and ores are without value unless metals can be produced from them economically. Nor is it the metallic minerals alone in which our industries are concerned; the non-metallics form the basis for the wide range of chemically-controlled industrial processes. The Bureau, therefore, serves a wide clientèle and our interest in its welfare is almost personal in so far as we serve the chemical and metallurgical industries.

It has been an open secret for some time past that the present director of the Bureau, Dr. FREDERICK G. COTTRELL, plans to retire at an early date. His appointment on the resignation of the previous director, Mr. MANNING, was a merited honor. Moreover, it was advisable in the interest of maintaining the spirit of the organization and continuing its work until the proper man could be found to take the post permanently. Dr. COTTRELL neither sought nor desired the position, realizing that its administrative nature would not be wholly to his liking. His friends, likewise, felt that he would be wasting unusual talents of a high order in a place which offered little opportunity for the exercise of them.

Thus we are confronted with the necessity of securing a new director for one of the most important bureaus in the Department of the Interior. All will agree that the greatest care should be exercised in making the choice. The position calls for certain qualifications that are quite obvious. Primarily, we suggest that it seems appropriate that the director of the Bureau of Mines should be a mining engineer—one experienced in the theory and practice of mining, skilled in administration and organization, sympathetic with the related subjects of chemistry and metallurgy and having a broad view of the mining industry and its relation to the welfare of the country. In addition to these qualifications the incumbent should be in a position to make that sacrifice which a Government salary entails, and yet he must not be so secure in his independence as to have lost ambition and initiative.

A number of men suggest themselves in this connection—men of the type of POPE YEATMAN, R. M. RAYMOND, A. H. ROGERS or ARTHUR THACHER. Any one of these would bring to the office administrative ability and technical knowledge of a high order, combined with familiarity with all phases of the mining industry and a salutary knowledge of business.

We commend their consideration to those officials of the Government on whom will fall the responsibility of making the appointment.

## Competitive Conditions In Commodity Markets

**F**OR many months past there has been what is commonly called a "sellers' market" in the majority of commodities. There has been competition, but it has been competition among buyers rather than competition among sellers. We cannot forget, however, how suddenly market conditions have changed at times in the past and there is reason therefore to expect that as many commodities are now swinging from the sellers' to the buyers' side the swing will be more or less violent.

If there had not been compensating influences the resulting tendency in recent times would have been for competition among manufacturers to become more violent each time the market turned against the sellers. One great compensating influence has been the growth of a feeling on the part of manufacturers that the individual must not do something that will prove harmful to the class. This is a substitute for the price agreements that are interdicted by the common law, written specifically into the statutes by the Sherman "anti-trust" act of 1890.

There is a serious question whether this co-operative feeling will be as prominent in the competition that is to come as it has been in the recent past. Some new influences have arisen. There has been much of what is called "profiteering" and in a given industry the amount of "profiteering" attempted by the individual sellers has varied.

In some industries there has been a wide division, some sellers having very plainly been profiteers, or seekers after the maximum prices obtainable from anxious and nervous buyers, while other sellers have been punctilious, even overscrupulous, in their efforts to avoid even the appearance of profiteering. As a result of these divergencies in attitude the men engaged in these industries are not in as close harmony with one another as was formerly the case, and the outcome of this situation may be a disposition to compete more keenly than in the last competitive period.

Another new condition is that both on account of profiteering and on account of the inability of some manufacturers to meet their customers' requirements in the past year or more many buyers are thoroughly disgruntled with their regular sources of supply and have registered vows that upon the first opportunity they will take their custom elsewhere. There will therefore be a great deal of "swapping" of customers. In many trade channels it has been the common practice among the majority of buyers to stick to a certain source of supply, their experience having been that thus they will best be "taken care of" in times of scarcity of the commodities involved. Many buyers now feel that instead of being taken care of they have been left entirely in the lurch or have been exploited to the limit—that in

other words the test has been pushed beyond the yield point and merely kept inside the breaking point, so that a permanent set has been acquired, and the permanent set means another source of supply for the future.

As to the attitude of sellers toward the buying trade, many have recognized frankly that after the period of famine and unreasonable prices they would have to buy their way into the trade again, and with large profits accumulated they are willing to devote a percentage of those profits to the buying process, to the selling of goods at a loss if necessary in order to purchase a clientele.

From a consideration of these circumstances it may be concluded that there are distinct possibilities of our seeing keener competition in some of the commodity markets than has been witnessed for a long time past or than was ever expected to appear again.

### Who Is

#### A Chemist?

RECENTLY we noted in a valued contemporary of such high standing that it pains us to read them, two advertisements of chemical "positions vacant," which showed a striking lack of appreciation of what a chemist is.

One of these advertisements wanted "a graduate chemist or one who has *almost completed the course*" (the italics are ours); and then proceeded to state that analytical and investigation work in an almost unlimited field "in connection with manufacturing processes in many industries" was to provide "intensely interesting work, practically no routine." We wonder how that man who has only "almost completed the course" is to care for this field involving "manufacturing processes in many industries." He certainly would have to show unusual promise.

The other advertisement to which we refer wanted a chemist to do research work in one of our industries in which there is large opportunity for new investigation, but where extremely difficult problems are to be met. This position was to be filled by someone who was asked to state "age, education, past position, *if any*, etc." (Again the italics are ours.) We wonder how any man who has never held a position in chemical work before is to take advantage of the "good prospects" which this advertiser offers.

It is high time that our industries realized that a man fresh from college is not a full-fledged chemist. At this stage in ordinary circumstances he has not reached even the end of an apprenticeship. It is also high time that the chemists of the country made clear to the industries what they can do and who belongs within their learned cult.

It is almost a temptation to urge that no one should be permitted to style himself "chemist" unless he had passed certain qualifying tests. This very point was emphasized by Dr. M. L. CROSSLEY at the last meeting of the American Chemical Society in his address on "The Qualifications of Organic Chemists." Until we get some means of thus identifying the qualified members of our profession we are bound to be discredited in the eyes of industry, which inevitably through misunderstanding of the facts will seek out the man who has "almost completed the course" or will ask for the "previous position, if any," in the experience of one to engage in investigation work and in the solution of extremely difficult chemical problems.

### Poor Fish

DR. JACQUES LOEB, of the Rockefeller Institute, has made many and profound studies of tropisms, and published several books on the subject. A tropism is a non-volitional act. Perhaps we can best explain it in the example of a species of fish with which Dr. LOEB was at one time experimenting. The fish were heliotropic—that is, the presence of light in a dark place compelled them to turn toward it. Thus if such fish are placed in a globe and if the globe be taken to a dark room into which a lighted candle or other light is brought they will forsake everything and keep their noses pressed against the side of the globe nearest the light. Move the light and all the fish will move to face it and stay right there as long as the light does; stay there until they float belly up on the surface with the life gone out of them. Disagreements, the search for food, love-making, and all the other joys and sorrows of fish life are forgotten or abandoned against what seems a grand passion of curiosity. Take the light away or make the whole room generally light again and the fish will swim about as before just as though nothing extraordinary had happened.

But if, while they are engaged in what seems like pop-eyed and perpetual wonder at the burning candle, we secretly lead into the water in which they swim a tube conducting carbon dioxide, we shall soon meet an amazing phenomenon. As the saturation of the water with  $\text{CO}_2$  reaches a given point the apparent curiosity of the fish ceases, and one by one they give up their posts of observation and swim around and back and forth with no more reference to the burning candle or the single bright light than a society gold-fish. The little extra carbonic acid made them just like others. The phenomenon is an instructive example of photochemistry, and a demonstration of the theory of mass action in life.

Now suppose these fish were people and could talk. And suppose we should ask the biggest one why he looked at the candle.

"Why," he would reply, "I observed a new element in our world, and I didn't know what it was. So I made up my mind that I would not leave my post until I learned what it was, or at least what it would do. 'Here,' I said, 'is danger, and only death itself can drag me from my vigil until I know what it signifies!'"

Then we might ask him why he quit looking at it and gave up his quest. In reply he would declare that he finally reached the conclusion that the light was not dangerous; that it was a thing that did not concern the life of the colony. At this point he dismissed the subject from his mind and went about his business. Or he might offer any other reason *ex post facto*. An intimation as to the influence of carbon dioxide upon his opinions would offend him. He would want us to understand that he knew what he was about, that he was a fish of character, and not to be swayed in his opinions by carbon dioxide or anything else. If we were to ask him why the other fish also began to swim about freely at the same time as he, he would distend his chest and inform us with a dignified swish of his tail that he was probably not wholly without influence among his neighbors. Other fish would claim similar originality, fishy books would be written on the claims of the various leaders who brought the community back to "normalcy," and the history of the great light disturbance would become a subject of academic dispute and later a standard means of training the minds of young fish.



Now we're like that; very like it. For the past few years this country has been very prosperous and money has been easy to make. Thinking has hardly been necessary. We know of a young engineer who knew his business moderately well, but found it more profitable to work as a journeyman carpenter. Work has been very well paid. Hundreds of thousands of persons—men being scarce—have consequently declared that labor is the true source of all wealth; and there are tons of so-called literature to prove it. This means that, given a man, a horse and a cart, the cart and its earnings belong to the horse.

Gradually conditions are changing. The impossible has happened. American dollars have become so precious in comparison with foreign money that the foreigner refuses to buy of us. Ten dollars a day and bankers' hours—which are the hours banks are open rather than the hours bankers work—are still standards of payment for certain kinds of labor, but the jobs are getting scarce. Labor is beginning to underbid, and while we insist that labor is not a commodity and that every man and woman who works in an organization is part of its human staff, the fact remains that a little competition is a wholesome thing. There are limits to the earning power of a husky shoulder carrying a hod, especially in comparison with the earning power of thinking. Tropisms are less valuable than thoughts.

Now if our good dollars have got to be so valuable that the poor foreigner can't use them, then we must do something besides strut about and explain our glory and our might and our wisdom in making our dollars so valuable. When we do that we are merely displaying tropisms. What we need to do is some thinking, some real thinking, to get a line on the causes and to plan out a line of conduct that will be wise instead of foolish; intelligent instead of smart. A little season of meditation will do the best of us no harm. Then we may look inwardly and consider how much of what we think is mere tropism; conclusions reached because of influence, weather, situation, liking, etc., on the one hand, and on the other how much of our thinking is pure constructive thought. When hard times threaten it is impossible for us to get ahead by repeating old saws or by exercise of mere tropisms.

#### Need for Technical Advances In Carbon Black Technology

**C**ARBON black is a highly important commodity. It is as essential as paper to the printing industry, every printed word almost being a composite of countless particles of it, which when mixed with linseed oil form an ink that is not tarry and instantly divides its oil with paper, giving a dry, adherent, black film over the wetted impression area. During the past five years the rubber industry has found it the superior compounding ingredient. The familiar black cord automobile tires are taking twenty million pounds, half the annual production and twice the amount consumed in printing inks, and promise an unlimited market.

West Virginia, the birthplace and home of the gas-black industry, as well as most all other states having natural-gas resources, does not welcome the prospect of having this fuel, so potential for industrial advancement and domestic comfort, all burned up in a few years to extract only one pound and a half of carbon black per 1,000 cu.ft. of gas. Legislation prohibiting the use of gas in this industry has failed so far on constitutional

grounds when tests of its legality were carried to the highest courts.

The remedy for the situation depends on the industry making a more satisfactory showing. Ninety-five per cent loss of the carbon in the original gas certainly looks bad, without even bringing up the subject of calories escaping in hundred per cent lots. That some effort has been made to improve the technology of the industry is well known. Many patents form a record of the creation of new ideas. Unfortunately, however, most of these were ill conceived and effected nothing. A tarry lampblack or a gray cokypowder are usually produced by all these would-be efficient processes.

In this issue we are publishing a full description of the channel process by ROY O. NEAL of the Bureau of Mines. In a subsequent number we shall describe the other commercial processes, and in the future we shall be looking for new developments to present to our readers. Every investigator on this subject should first acquaint himself with the processes now in use and then study the reactions and products, physically and chemically. Other sources of heat than the partial combustion of the gas may possibly be used, but not in thermally decomposing the gas into carbon and hydrogen. Pyrogenetic reactions take place with the hydrocarbon decomposition products, yielding tarlike particles which if further heated produce coke dust having no resemblance to carbon black. The reducing flame composition is undoubtedly necessary as well as its temperature, but the means of obtaining these are various and should be the basis for developments of the future.

#### A Note On Research

**S**UPPOSE, it was lately suggested, that GREGOR MENDEL, the Abbot of Bruenn, had asked the head of his monastic order for land and labor and the privilege to carry on experiments in heredity. Of course, the request might have been granted, but he might also have been advised that it would be better to leave that kind of work to others. Such things often happen in the best of organizations. It may occur in a laboratory almost more easily than anywhere else.

We know that the sloppy man is a nuisance, we are fully alive to the hopelessness of results from disorderly minds, but we maintain, nevertheless, that the system and order which issue from incompetent administration is often the devil's own work. Research in industry points to a definite goal, but the trails found on the way are not to be despised. These trails are dividends, and to miss them is to miss the fruits of research. A proper division of work is necessary; great research laboratories must have analysts to speed up the achievement of men of originality; some persons are full of invention and short of accomplishment, while others can do only what they are told to do, although in this they are amazingly effective. But a false concept of system and order must not be allowed to kill invention or to discourage it. When a man of research has an idea it is well to advise with him and see if it cannot be brought to development with the help of his own enthusiasm. About the worst thing to do is to take the idea away from him and to kill his initiative because of some rule. Research is the occupation of a gentleman, and this fact should always be borne in mind. It is a very distinguished calling.

## Readers' Views and Comments

### More and Better Tools Needed

*To the Editor of Chemical & Metallurgical Engineering*

SIR:—There have been several references in CHEMICAL & METALLURGICAL ENGINEERING recently to a subject that has seemed to me one of the most important that could be considered by our technical societies, for indirectly it leads to a consideration of the proper function of the technical school and of the best training for technical students.

In the issue of Sept. 22, in describing the meeting of the American Chemical Society in Chicago, Major Howe's speech at the dinner was summarized as "a plea for better tools, among which the most important was the publication of tables of physical and chemical constants."

In the issue of Sept. 8 J. W. Richards writes at length under the head of "More and Better Tools Wanted" of the hiatuses in our knowledge of physical and chemical constants. Not long ago the American Chemical Society undertook a drive for \$100,000 to make a collection of constants for publication, a work which had been begun by the International Congress of Applied Chemistry with its three volumes of "Tables Annuelles."

I am inclined to believe that the most necessary thing at present is not so much further compilation of existing data as it is the determination of new constants. In preparing the last edition of my "Metallurgists and Chemists Handbook" I made some inquiry into the source of a number of the constants there published and was amazed to find how many of them were based on work done in the '80s and '90s.

Having had my attention called to one group of melting points, I tried to find later determinations than the early '90s and spent every evening for nearly three weeks in the Library of Congress in this attempt, without success. I am convinced that a very large proportion of our published data rests on work done between twenty and thirty years ago and that almost the entire field needs rechecking.

Who is to do it? It does not seem to be the place of the consulting engineer or of the private research or analytical laboratory. It is expensive and absorbing work, and contributes not at all toward meeting the H. C. L. On the other hand, the logical place for this work would appear to be the technical school, the college laboratory and the subsidized institution, such as the Bureau of Standards. There the professor or director has a large corps of assistants, his own living is already taken care of, and apparatus and chemicals are usually available without stint. Especially important for research work of the kind I have indicated is the first point. The professor can cover a large amount of territory in a short time, checking the results of different observers against one another, yet none of his assistants is wasting his time, for the training is valuable to each of them.

Yet apparently there is no longer thought in the technical schools of anything but "industrial fellowships." A friend of mine, head of a large chemical company, told me he recently received in one week pressing invitations from six colleges to establish industrial fellow-

ships. His own comment was, "I refused. Either I was hiring the professor, and it would be too cheap, or I was hiring an untrained student, and it would be too dear."

Again quoting from CHEMICAL & METALLURGICAL ENGINEERING, page 565 of Sept. 22, in referring to the Chicago meeting of the American Chemical Society, it says: "The Qualifications of Organic Chemists" was presented by L. Crossley, chief chemist of the Calco Works, in which he, like Dr. Rose (and both Drs. Crossley and Rose have had wide experience as professors of chemistry before entering into industry), felt that so-called utilitarian work was of least value, while training in general principles in those studies which are necessary for the meditations of thoughtful men was of leading importance."

Isn't it about time to get away from the industrial fellowship idea, and the publication of constants idea, and leave the former to the practicing chemical engineer and the latter to individual enterprise, and give a little attention to research work on the determination of some of the needed constants? It will probably be said that I write "as one whose ox is being gored." Who else is there to write on the subject but those who are vitally interested in it?

New York City.

DONALD M. LIDDELL.

### There's Trillions in It!

*To the Editor of Chemical & Metallurgical Engineering*

SIR:—The Exposition brings to light all sorts of unexpected things. A gentleman who owns 6,400 acres of shale land showed a report that he had received from a technical "expert." He refused to give up the expert's name, so I am restricted to the mere record of his glorious imagination, which seems too rich, too active, too venturesome to be permitted to blush unseen. If we could only transform this imaginative energy into foot-pounds, I believe we could run a blast furnace with it. Like all men of similar (but lesser) gifts, he presented two sets of figures in his estimate of the industrial value of the gentleman's property, which he calls respectively "high" and "average."

The value of the shale per ton is declared to be:

	High	Average
Oil, 75 gal., Penna. grade.....	\$12.50	\$7.50
Gold.....	65.00	10.00
Silver.....	33.15	5.00
Platinum.....	86.00	8.00
Potash.....	12.00	6.00
Ammonium sulphate.....	6.00	3.00
	\$214.65	\$39.50
Production cost.....	5.00	5.00
"Net value" per ton.....	\$209.65	\$34.50

The report continues: "Actual surveys show an average surface deposit of 1,000,000 tons of shale per acre, or an average profit of \$34,500,000 per acre. The total tract is 6,400 acres and the prospective earnings therefore 6,400 times the above sum." Here's where we begin to see wealth! We are considering only the surface deposits and we can't tell how much more there may be underneath. But taking only the so-called



"average" or conservative figures we have a prospective clean-up of twenty-two billion, eight hundred million dollars. That's something like! It gives a man a chance to make John D. Rockefeller look like thirty cents. And these, remember, are the conservative figures. Using the "high" estimates, the happy investor can see value up to one trillion, three hundred and forty billion, with a little matter of 760 million dollars on the side.

The only prospectus to compare with this that I have ever seen is one that I came across a score of years ago when the trusts were forming, and that is a mere bagatelle in comparison. It reads:

**AMERICAN RABBIT FARM CO., UNLIMITED,**  
to be organized under the laws of the Philippines  
Prospectus

Rabbits commence breeding at six months and have drops of eight every three months. It is proposed that we commence with ten pairs, ten males and ten females, which exclusive of land will call for an investment of four dollars, resulting in the following product:

3 months.....	80	1 year, 3 months.....	4,160
6 months.....	160	2 years.....	279,680
9 months.....	880	3 years.....	306,446,720

This product can be sold in the market certainly at five cents each, giving a gross income in three years of \$15,322,366, to be deducted from which are the following expenses:

Rent of land, per annum.....	\$4,000	\$12,000
Superintendence, per annum.....	2,000	6,000
Feed (estimated), per annum.....	2,000	6,000
		\$24,000

This leaves a net profit on a four-dollar investment of over fifteen million, two hundred and ninety-eight thousand, three hundred and thirty-six dollars (\$15,298,336) in three years.

The Company will issue Capital Stock to the amount of four dollars divided into 400 shares, par value one cent.

Subscriptions are invited to the Capital Stock of the Company at par.

The right is reserved to allot less than the amount applied for hereunder.

When I think of poor old Colonel Sellers and his eye wash I—why, say, Mr. Editor, I just pity him!

New York City.

MARTIN SEYT.

**Data on Operation of Continuous Type Lime-Soda  
Ash Water Softener**

*To the Editor of Chemical & Metallurgical Engineering*

SIR:—I wish to present a number of corrections to be applied to the article on "Data on Operation of Continuous Type Lime-Soda Ash Water Softener," which appeared in your journal of Sept. 15, 1920, page 526.

The paragraph on "Analytical Data Determinations" has the following statement: "Since the water was acid in character, these readings were obtained on the raw water with the exception of C." This statement is wrong chemically and should be: "Since only the methyl reading could be obtained on the raw water, the carbonate hardness was due to bicarbonates alone."

In the paragraph on "Interpretation of Data," some one inserted a statement as follows: ". . . the  $\text{CaCO}_3$  forming a gelatinous precipitate." This is not quite true and should be: ". . . the  $\text{CaCO}_3$  forming an amorphous precipitate which slowly crystallizes."

Cincinnati, Ohio.

H. C. FISHER.

**The Type of Explosive in Wall Street Explosion**

*To the Editor of Chemical & Metallurgical Engineering*

SIR:—One of the most important points in the Wall St. explosion is to determine the type of explosive actually used and perhaps by discovery run down the investigation to a single track and finally indentify the plotters of this crime through this channel. The first question that interests the public is, "What kind of explosive did they use, and where did they get the supply?" From all the facts, materials and observations in possession of the authorities, one should by systematic and scientific examination and elimination arrive at an accurate conclusion, quite possible under similar circumstances, and thus determine whether any TNT, dynamite, picric acid, smokeless powder, black powder and other explosives were used in this criminal exploit.

The amount of property damage done by this explosion is surprisingly small. With the exception of window smashing there is no material loss of property over \$150,000. Furthermore, instead of reducing the wagon carrying the explosive into splinters, which would be the case with powerful explosive like dynamite, picric acid or TNT, the explosion simply broke it into small pieces large enough to be collected and reconstructed. This evidence shows on its face either that the explosive was not powerful or the quantity used was very small, say not exceeding 50 lb., and probably nearer 25 lb.

All explosives are recognized by their physical and chemical characteristics and are easily differentiated from one another by the report or sound of explosion, flame, smoke, fumes and the residue they leave behind. For instance, a smokeless powder burns and explodes without smoke, leaves no residue and has a light yellowish flame; on the other hand, TNT and picric acid burn and explode with a deep orange yellow flame, dark fumes, but leave no residue. These last two explosives explode with sharp and deep detonation and when exploded in the open carry loose particles of TNT and picric acid in the air and color the fumes somewhat yellow. All the evidence obtainable in this case indicates that smokeless powder, TNT and picric acid were not used in the explosion, since no black fumes were observed and no deep orange yellow flames, and, most important of all, such explosives would not leave any residue. In the Wall St. explosion the explosives left a residue, after the explosion, which was scattered all over the ground and some of it was attached to the window weights which actually came in contact with explosive matter.

After eliminating TNT, picric acid and the smokeless powder there remains black powder, dynamite, nitro-starch and chlorate powders, which leave a distinct residue after the explosion. Although the black powder leaves a residue, its use is not likely in this case, because it is a weak explosive and leaves behind such a large volume of black smoke that it can be easily recognized by almost everybody.

Dynamite upon explosion leaves behind a residue consisting of sodium carbonate, sodium sulphate and other sulphur and soda compounds, if sulphur was used in the manufacturing process.

Nitro-starch explosive leaves behind the same ingredients as dynamite. The chlorate powders leave sodium and potassium carbonates, sodium and potassium sulphates and the chlorides and the sulphides of the same

salts. Either potassium or chlorine in the residue will indicate at once the presence of chlorate powders. One of the principal points testified by witnesses was that the explosion sound was not sharp and short as dynamite but rather long and rumbling. As a matter of fact, dynamite explodes with a short and sharp detonation, a short flame and with only gray-white fumes. Again, 25 lb. of dynamite would do more damage than was caused in the Wall St. explosion. Moreover, it would make a big cavity in the street just under the wagon in spite of the fact that the explosive was placed 3 ft. from the ground. Nitro-starch explosives are principally made by one manufacturer, and its sales could be easily traced by the authorities. Therefore it is unlikely that the plotters used this last explosive at all.

Chlorate of potash and soda are the only ingredients of this explosion that remain and fall under suspicion. There is no manufacturer of explosives in this country regularly making powder containing chlorates or perchlorates. Chemical examination of the residue has indicated conclusively the presence of potassium, chlorine and antimony. It is possible that the plotters of this crime bought their raw material in small quantities from chemical houses, drug stores, fireworks makers, etc., and by mixing them with charcoal, nitrobenzene, sulphur and antimony they concocted an explosive imperfectly balanced but strong enough to create this disaster. Had the explosive been a regularly manufactured product it certainly could have done more damage than was experienced in Wall St.

Another important point on which all the witnesses agreed is the length of the flame that came out from the explosion, burning window shades seven stories high. Now, there is only one explosive that has such a long flame, and that is the chlorate explosive.

Most people have never seen an open explosion of any explosive, hence they have no perfect idea as to the physical characteristics of the reaction. While their testimony is not contradictory, certainly it is not constructive. Estimates of the flame, sound or the fumes are widely apart. It would be a very useful as well as a practical procedure to take these witnesses in an open space and explode before them different charges of explosives, say 2 lb. each, from a safe distance (200 ft.), and discover whether their memory as to the character and the intensity of the sound, the flame, the smoke and fumes could be refreshed. While the chemical examination of the residue indicates the presence of the chlorate explosives, a practical demonstration such as mentioned above would strengthen by physical observations the conclusion brought about by chemical examination.

This matter deserves the attention of state and Federal authorities and it is to be hoped that they will carry out these practical suggestions in order to satisfy the demands of a careful investigation.

In conclusion I would re-emphasize the fact that the determination of the type of explosive used in the explosion can thus be made by two tests.

1. Chemical examination of the residue.
2. Physical examination, including the testing of the evidence from witnesses.

In the chemical test, the residue consists of a comparatively few number of ingredients, therefore this examination is short and comparatively easy. The physical examination includes reproducing the sound, the flame and the fumes, which can be determined from

persons who actually saw the explosion, and the same can be repeated by practical test in the field.

From all the facts in my possession one can safely conclude that the explosive actually used in the Wall St. explosion was not a well-made manufactured product, but was concocted by the plotters of the crime and made up of such ingredients as they could buy. The explosive was not confined in any stout metal container or bomb, but it was put probably in a wooden box and covered by iron slugs and window weights. That is the reason why the damage was mostly caused by concussion and expansion of gases rather than by metal projectiles or fragments.

It is of course possible to compound explosives containing a number of materials such as TNT, picric acid, nitrobenzene, chlorates and nitrates. An explosive of this type would not show any decided characteristics and the examination of its ingredients would not lead to anything definite, but it is my opinion that even if such a mixture was used the basic ingredient of the explosive used in Wall St. consisted mostly of chlorate. If small quantities of other explosive materials were used they did not materially change the character or the power of explosion.

JOHN R. MARDICK.

New York City.

### A Suggestion to Exhibitors

To the Editor of *Chemical & Metallurgical Engineering*

SIR:—The recent Chemical Exposition can scarcely have failed to impress both the technical man and the layman by its extent and by the care with which the various exhibits were prepared. As an advertising medium for the chemical industries and as a method for presenting the latest in chemicals and equipment it was excellent.

It is all the more deplorable that so many of the exhibitors placed their booths in charge of salesmen rather than under the direction of men who were thoroughly qualified to explain their respective displays. In at least half a dozen instances, to my own knowledge, well-intentioned inquiries about exhibits were answered by statements which would have been ludicrous had they not displayed such gross ignorance of facts. Surely progress in the chemical industries will be enhanced as much by the liberal use of technical men at the expositions as by the use of those men trained in salesmanship only.

ALLEN ABRAMS.

Cambridge, Mass.

### Aluminum Trade of Japan

Although the aluminum industry is now well established in Japan, most of the forty-four manufacturers conduct business on only a small scale, chiefly for home consumption, states a recent article in the *World Salesman*. The variety of articles manufactured is comprehensive, including all kinds of cooking utensils, candlesticks, pipes, cigarette cases, alcohol lamps, army canteens, bottles and various kinds of castings. Japan is entirely dependent upon the United States and England for raw material in connection with this industry, though at present, in co-operation with an American aluminum company, plans are under way for the erection of a plant in Fukui Prefecture which, with the help of experienced American workmen, will later be able to supply the raw aluminum material needed. In 1918 imports of ingots from the United States were 1,466,967 kin (kin = 1½ lb.) valued at 1,662,471 yen, and from England they reached 12,346 kin.





Photo by courtesy of the Cleveland Convention Board

## Cleveland Meeting, American Electrochemical Society

Report of Technical Sessions, With Discussion of Papers on Electrometallurgy and Electrochemistry—  
Visit to the Nela Research Laboratories and Industrial Plants—  
Banquet and Other Social Features of the Meeting

THE thirty-eighth general meeting of the American Electrochemical Society was held at Cleveland, Sept. 30, Oct. 1 and 2, with headquarters at the Hotel Statler. In spite of the fact that Cleveland is centrally located, and further, that this was the first meeting of the Society in that city, the attendance was not as large as usual. Whether this is to be ascribed to the increase in railroad fares or to some other cause is not apparent. Certainly the technical sessions which are herewith reported fully, were quite as lively and interesting as usual and the hospitality and entertainment afforded by the Cleveland members, assisted by the Cleveland Engineering Society, elicited approval and congratulations. In fact the refreshment provided was of a distinguished order.

### Social Features

A complimentary smoker was tendered by the National Carbon Co., at which entertainment was provided by professional talent and members of the Society. The success of the banquet was assured by the presence of a large number of ladies and by a short but imposing list of after-dinner speakers. Dr. A. W. SMITH, professor of chemistry of the Case School of Applied Science, presided as toastmaster, and responses were made by Dr. CHARLES S. HOWE, president of the Case School of Applied Science; Dr. W. S. LANDIS, president of the American Electrochemical Society; Dr. CHARLES F. BRUSH, inventor of the arc light, and Dr. E. P. HYDE, director of the Nela Research Laboratories.

Taken as a whole, the meeting was one of unusual

interest, and the Society is indebted to Dr. N. K. CHANEY, chairman of the local committee, and his efficient coworkers of the Cleveland Engineering Society. The visiting ladies will long remember the attractive program arranged for them under the direction of the Ladies Committee, headed by Mrs. E. R. GRASSELLI.

### First Technical Session, Thursday

#### HEAT LOSSES THROUGH ELECTRODES

The first technical session was held in the large hall of the Hotel Statler on Thursday morning. M. R. WOLFE and V. DE WYSOCKI, of Lehigh University, gave an account of their measurements on the "Heat Losses Through Electrodes." A six-ton Heroult furnace was provided with three electrodes, each 38 cm. in diameter and made of ordinary amorphous carbon. In working up the calculated heat flow, Hansen's value for thermal conductivity, 0.016 cal. per second per centimeter cube per degree C., was used. Each electrode was provided with a water-cooled ring immediately above its exit electrode, the average rise in temperature of the water cooled connection at varying distances above the roof. The grams of water flowing per second was 427.8 per electrode, the average rise in temperature of the water 22.9 deg. C., and the sum total of heat in the cooling water for the furnace was 123.1 kw. Since 650 kw. was supplied to the furnace, the total electrode loss was therefore 18.7 per cent of the power used. Of this total, 18.5 kw. was absorbed by the upper cooling contact holders, and 104.6 kw. by the lower water-cooled rings.

The paper was discussed by Messrs. TURNBULL, HERING, FINK and RICHARDS. It was pointed out that Hansen's value, 0.016, was determined about fifteen years ago and that in the meantime the conductivity of the carbon electrodes had changed. A redetermination of this value seemed advisable. At all events, the resistivity of the electrodes under investigation ought to be included in Wolfe and Wysocki's report. Furthermore, it was argued that the 104.6 kw. absorbed by the lower water-cooled rings was partly derived from the roof and that therefore the value reported for the electrodes was too high.

#### HEAT CONTENT OF STEEL AND SLAG FROM AN ELECTRIC FURNACE

A. M. KUHLMANN and A. D. SPILLMAN, of Lehigh University, reported on a series of calorimetric determinations of the heat content of liquid steel and liquid slag from a 6-ton Heroult steel-casting furnace at the works of the William J. Wharton, Jr. Iron & Steel Co. A Fery radiation pyrometer was used for high temperatures and either a platinum-iridium thermocouple or platinum resistance thermometer for the lower temperatures. The slag analyzed 23.5 per cent  $\text{SiO}_2$ , 24 per cent  $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$  and 42 per cent  $\text{CaO}$ . The mean specific heat of the solid slag up to 810 deg. C. was found to be  $0.133 + 0.00011t$  and the heat content,  $Q$ ,  $0.133t + 0.00011t^2$ . The value of  $Q$  for liquid slag was found to be 476 cal. at 1,190 deg. C. and 520.5 cal. at 1,250 deg. C. The heat content of the liquid steel (0.1 per cent C, 0.2 per cent Mn) was determined and at 1,900 deg. this was found to be 325 cal.

In the discussion of the paper that followed Dr. CARL HERING pointed out that in dropping the molten slag or steel into the water of the calorimeter, considerable steam was evolved which would naturally lead to errors in the thermal values. W. S. LANDIS referred to errors that would arise when using an optical pyrometer in making temperature determinations of liquid slag on account of the emissivity of the slag depending largely upon its composition. Dr. J. W. RICHARDS agreed that probably the values reported were high and that the temperature of the liquid steel was nearer 1,800 deg. than 1,900 deg. Dr. HERING suggested that the molten steel or slag be poured into lead or into a metal cup or crucible and this introduced into the calorimeter, thus largely avoiding the formation of steam.

#### ELECTRICAL RESISTIVITY OF REFRACTORIES

The third paper of a series on the physical properties of specialized refractories was presented by M. L. HARTMANN, A. P. SULLIVAN and D. E. ALLEN, of the Carborundum Co. research laboratory. The first two papers were read at the Boston meeting of the society.<sup>1</sup> This contribution dealt with the electrical resistivity of refractories at high temperatures.

In the design of electric furnaces it is important to know the electrical resistivity of the refractories used in those portions of the furnace which contain, or come in contact with, the electrodes or resistor material. Practically no data have been published on the resistivities of commercial bricks except those by Stansfield, McLeod and McMahon.<sup>2</sup> These investigators determined the resistivities of silica, chrome, magnesia and fireclay from 600 to 1,565 deg. C. Hering<sup>3</sup> has compiled from the literature the resistivities of many substances, but these do not include commercial refractories.

Using a method similar to that employed by Stansfield, McLeod and McMahon, the authors determined the electrical resistivities of nine commercially used refractories, at temperatures up to 1,500 deg. C. Measurements were taken while heating up slowly and while cooling down slowly, the thermocouple measuring temperature being outside the specimens. The amount of temperature lag thus involved was approximately determined. The results, which are summarized in the table, are necessarily only approximate, but show the relative resistivities of the different materials and the general order of magnitude of their resistivities up to 1,500 deg. C.

The paper brought forth considerable discussion in which Messrs. SAUNDERS, FINK, HERING and RICHARDS participated. It was pointed out that resistivities of refractory bricks should always be accompanied by a chemical analysis and grain size. Furthermore, whenever possible the binder used in the brick ought to be taken into account. A silica brick with 97 per cent  $\text{SiO}_2$  and 3 per cent of a highly conducting binding material might have decidedly lower resistivity values than a 93 per cent  $\text{SiO}_2$  brick with a low conductivity binder.

#### DETERIORATION OF NICKEL RESISTORS

The high cost of nichrome wire and the onerous conditions attached to a license for its use led F. A. J. FITZGERALD and GRAN C. MOYER to study the use of nickel wire as a resistor in electric furnaces. It seemed possible that for some purposes nickel wire might prove to be a suitable substitute in spite of its high thermal coefficient of electric resistance, for this disadvantage can be overcome, and its deterioration by oxidation, since this, with reasonable precautions, can be diminished so as to give a fairly extended life.

It was found, however, in some heating devices that nickel resistors broke down after very short service, for although there was no appreciable oxidation the resistor wire had become so very brittle that the slightest bend would break it. This effect was thought at first to be due to carbonization of the nickel, since the wire had been embedded in cement and a heat insulator

<sup>1</sup>CHEM. & MET. ENG., vol. 22, p. 729; April 21, 1920.

<sup>2</sup>Trans. Amer. Electrochem. Soc., 1912, vol. 22, p. 89.

<sup>3</sup>MET. & CHEM. ENG., 1915, vol. 13, p. 23.

ELECTRICAL RESISTIVITIES OF COMMERCIAL REFRACTORIES \*

	Cold	800° C.	900° C.	1,000° C.	1,100° C.	1,200° C.	1,300° C.	1,400° C.	1,500° C.
Silica	< 125 Meg.	2.38 Meg.	765,000	300,000	126,000	62,000	30,900	16,500	8,420
Bonded carborundum (Carbofrax C)	< 127 Meg.	835,000	477,000	197,000	75,000	29,500	15,200	10,100	8,590
Magnesia	< 137 Meg.	5.00 Meg.	1.24 Meg.	708,000	560,000	193,000	67,400	22,400	2,500
Zirconia (natural)	< 134 Meg.	558,000	224,000	131,300	53,800	7,710	2,100	968	412
Bauxite	< 133 Meg.	109,000	32,500	17,200	9,200	6,100	5,600	2,200	1,100
Fireclay (Grade A)	< 137 Meg.	57,600	20,600	10,800	6,590	4,160	2,460	1,420	890
Bonded carborundum (Carbofrax B)	107,200	12,550	8,220	7,420	6,320	4,160	2,420	1,435	745
Chrome	48.1 Meg.	803 ohms	375	171	78	63	77	85	41
Recrystallized carborundum (Refrax)	106.9 ohms	6.45	5.25	4.11	3.11	2.45	2.05	1.74	1.62

\* Data are in terms of ohms per cu. cm., except where megohms are noted.



containing carbonaceous matter. Further investigation showed that the real cause of the trouble was sulphur, which makes nickel wire brittle even at low temperatures, while the effect is very marked and rapid at temperatures above 500 deg. C.

When precautions are taken to prevent reaction with sulphur, nickel wire seems to stand up well as a resistor.

In the discussion of the paper, the question was brought up whether sulphur was the only cause of brittleness in nickel wires. To this Mr. FITZGERALD replied that they had confined themselves to the effect of sulphur and that analyses of the samples supported their conclusions. For example, in the original nickel sample only a trace of sulphur was found, but the sample subjected to sulphurous fumes for ninety-six hours contained 0.054 sulphur. C. P. MADSEN referred to the patent situation on the use of nickel as a resistor and to his elaborate experiments to determine the best refractory covering for incandescent nickel wire. Pure oxides were in general preferable to silicates. Dr. FINK referred to the bad effect of carbon on the ductility of nickel and the beneficial effects of manganese when added to the extent of about 2 per cent.

#### THE SÖDERBERG CONTINUOUS ELECTRODE

Dr. JOSEPH W. RICHARDS submitted a second report on the progress of the Söderberg electrode.<sup>1</sup> He described and commented upon the success of the three-phase installation of the Söderberg self-baking electrodes in operation at Anniston, Ala., since July 2 of this year. The furnace is rated at 1,800 kw. and is used for the manufacture of ferromanganese. An open top furnace of the usual ferro-alloy type is used. The working space is 12 x 20 ft., elliptical in shape. The three electrodes are each 32 in. in diameter and extend from the furnace up into the tamping house, which is 12 ft. above the charging floor. The total length, when a new section has just been added to the top, is 24 ft. and the weight, exclusive of the holder, about 13,200 lb. per electrode. The casing is formed of No. 18 sheet iron riveted together to the correct diameter, and provided with inwardly directed partitions, as previously described. One section 46 in. long weighs approximately 110 lb., or 2.4 lb. per in. In the baked electrode there are 18 parts of carbon per 1 part of iron shell. A new section may be required per electrode every five to fifteen days, according to the nature of the ore being reduced in the furnace and the current taken by the electrode. In the straight-line three-phase arrangement, it is almost impossible to get each electrode to take the same current, so the consumption will be somewhat different on each electrode. Holders and electrodes are suspended by wire cables controlled by hand.

The ore used was Caucasian di-oxide ore of high grade, 56 per cent manganese, with not sufficient iron for producing 78 per cent ferromanganese and not sufficient silica to give a proper slag volume in the furnace. Analysis of the ore showed 4.67 per cent moisture. The dried ore contained: Manganese 56.35 per cent, iron 0.80, silica 5.04, alumina 1.40, lime 1.90, magnesia 0.84, baryta 0.93, manganese dioxide 88.34, manganese mon-oxide 0.65.

Iron turnings were added, and picked return slag put back in the furnace to increase the slag volume. The average carbon consumption was 6.6 kg. per 1,000 kw.-hr. The ore was so fine in structure that it packed badly in

the furnace, causing frequent cratering. It was a difficult charge to work, requiring frequent stoking. Another furnace in the same plant, working the same ore with square baked electrodes, had the same difficulties from the packing of the charge.

The advantages for the Söderberg electrodes are:

1. Absolute continuity of operation, as far as the electrodes are concerned.
2. Smaller consumption of electrode carbon per given power supplied to the furnace.
3. Lower cost of electrode per given power supplied to the furnace.
4. Lower power losses in the electrodes.
5. Greater regularity of running of the furnace, and therefore less wear and tear on the workmen and the management, and greater uniformity of product.

In commenting upon Dr. Richards' report ROBERT TURNBULL suggested that it is more practical to state electrode consumption in terms of pounds per ton of product rather than pounds per 1,000 kw.-hr. The consumption per 1,000 kw.-hr. might be very low and yet the consumption per ton of product very high. The question was also raised whether or not the tamping house would interfere with the free operation of a furnace of the Heroult type. In reply Dr. Richards read a cablegram just received from Norway advising of the successful operation of a steel furnace equipped with Söderberg electrodes. Tests are furthermore under way in the substitution of the Söderberg for the graphite electrodes used in the manufacture of aluminum. In the case of the steel furnace, the Söderberg electrodes are made up and added in sections, thus permitting of the tilting of the furnace. At Anniston the ferromanganese furnace operated twenty-eight days during August with but thirteen minutes shutdown on account of electrodes. The carbon consumption was 14.2 lb. per 1,000 kw.-hr. A ferrosilicon furnace in Norway equipped with Söderberg electrodes is consuming but 12.6 lb. of carbon electrode per 1,000 kw.-hr. This compares favorably with Mr. Turnbull's figure of 11.6 lb. per 1,000 kw.-hr. when using standard carbon electrodes (65 lb. per ton of 50 per cent ferrosilicon).

#### ELECTRIC FURNACE SMELTING OF MANGANESE ORES

A paper of the above title, originally presented by E. S. BARDWELL at the spring meeting of the society in Boston (see CHEM. & MET. ENG., vol. 22, page 681, for the full paper), was brought up for discussion.

#### PHENOMENA OBSERVED IN ELECTRIC FURNACE ARCS

The last paper of the Thursday morning session was by J. KELLEHER, of the University of Toronto, on "Phenomena Observed in Electric Furnace Arcs."

In the first set of experiments a bath of iron-nickel alloy covered by an acid calcium silicate slag was melted in the electric furnace. To observe the arc under these various conditions the following arrangement was employed: An opening was made in the front wall of the furnace. The opening was then covered by a piece of sheet iron in which a pinhole had been drilled. The light emerging from the opening was allowed to fall on a ground glass screen, which was moved backward and forward until a clear inverted image of the arc was obtained, thus permitting sketches and even photographs of the arc to be made. In the normal arc, that is, one where the movable electrode is the negative pole, the flame apparently flows from the electrode to the slag, depressing the slag and flaring out to all sides, or to one

<sup>1</sup>For first report see CHEM. & MET. ENG., April 21, 1920, p. 732.

side. An arc length of about 3 inches could easily be maintained. Under these circumstances the arc was silent.

As soon as the polarity of the furnace was changed, a very unstable arc appeared. This arc started below the surface of the slag, the flame moving away from the slag surface and projecting particles of slag into the air with considerable force. The length of this arc could barely be maintained at a greater length than 1 in. The noise of the arc was loud and spluttering.

It had been noticed that if with a normal arc large currents were allowed to flow, the arc became noisy and had a tendency to quench itself, even at comparatively short lengths.

The results of numerous observations might be summarized as follows: A disturbance takes place in the furnace running on normal load with an arc when the electrode is near the slag surface, tending to increase the current. The regulator immediately starts to raise the electrode. The large arc maintains its original shape until the length becomes so great that it is ruptured. Immediately all the lesser arcs move away to the outer edge of the electrode, leaving about 75 per cent of the surface of the electrode end bare. This causes a rapid and large decrease in the current flowing, and the regulator commences to lower the electrode.

These arcs do not spread across the surface of the electrode until the surface of the slag is almost reached. They then suddenly spread over the whole electrode surface, causing a sudden and large increase in current, and the whole cycle of events is repeated.

A number of sketches were shown to illustrate the various appearances of the arcs.

Dr. HERING in discussing the paper referred to the rectifying action of the arc.

### Friday Morning at the Case School of Applied Science

#### INDUSTRIAL APPLICATIONS OF ELECTROLYTIC CONDUCTIVITY MEASUREMENTS

The use of accurate conductivity measurements on electrolytes, to determine therefrom variations in composition, such as using a salt solution of known conductivity as a solvent for sugar, and determining the amount of sugar by its effect in increasing the resistivity of the solution, was described by EARL A. KEELER. Such measurements may be useful methods of control in chemical manufacturing operations, such as boiler water concentrations, degree of evaporation, losses in tail-races, acidity of liquors, etc.

It is well known that many chemical processes or reactions can be followed and investigated by the measurement of the potential difference or changes in potential difference between two electrodes immersed in the solutions involved. These potential changes result from the changes in magnitude or nature of the ionic concentrations in the solutions undergoing the reaction or chemical changes. The determination of hydrogen ion concentration by means of the potential difference existing between a hydrogen electrode and calomel cell is the most notable example of this type of measurement.

While the technique of the hydrogen ion method has been highly developed during recent years, considerable work must be done to develop and design apparatus that will be satisfactory under the severe requirements of industrial use. Development work along this line is

progressing rapidly, and it is expected that material will soon be available for a paper on the "Industrial Applications of Hydrogen Ion Determinations."

In commenting upon Mr. KEELER'S results President LANDIS briefly described a practical installation at the cyanamide plant at Muscle Shoals. Cylindrical nitric acid containers were lowered into the wells in sections and in order to detect any possible leakage of acid several pairs of electrodes were placed a short distance away from the cylinders. The electrodes were connected in series with an incandescent lamp and a current supply. The lamp would light up automatically as soon as acid leaked out near the electrodes. E. R. MORTON criticized the method of calibrating the Leeds & Northrup cells used by Keeler. They were all standardized by comparing them with another standard cell kept by the company in its factory. There ought to be some quantitative measurement independent of this comparison method.

#### A NEW FORM OF STANDARD CELL

A new portable standard cell which is a satisfactory laboratory standard was described by C. J. RODMAN and THOMAS SPOONER. It is of the cadmium type of special design with the usual ingredients but having a container of hard glass with tungsten leads. Instead of the common H-type a compact concentric arrangement has been devised possessing a number of advantages. This cell is made either saturated or unsaturated, and other combinations besides the standard cadmium formula may be used in the present cell blank if desired.

The cell is a marked improvement over older types and is an interesting application of the tungsten seal in pyrex glass.

#### FARADAY'S LAW AT THE CATHODE

Since the direct invariable relation between electrical current and chemical quantity subsists only at the anode, and the present theory of electric current postulates current passing, as negative electrons, only toward the anode, is it not logical and reasonable to assume that the direct relation between electrical current and chemical quantity is true only at the anode?

On the other hand, the relation at the cathode being variable, and therefore probably indirect, Prof. J. W. RICHARDS declared that it was logical and reasonable to assume that this relation is not electrochemical but is more properly designated as chemical only—that is, it is governed by the chemical relation between the quantity of anodic element set free at the anode and the cathodic element. In other words, when the electric current sets free electrochemically at the anode a given amount of the anodic element or constituent of the compound, an amount directly determined by the electrochemical relations and Faraday's law, there is set free at the cathode that amount of the cathodic constituent which was chemically combined with the amount of anodic constituent liberated. This relation is chemical, and determined by the chemical equivalents of the substances in question, and subject to the variable valence of the cathodic element just as in any simple chemical decomposition.

If the above reasoning is valid and logical, it would follow that Faraday's law will apply fundamentally only to the anodic constituent, which is directly related to the quantity of negative electrons traveling to the anode; it would correspondingly follow that Faraday's law does not directly apply to cathodic constituents,



but only indirectly through the chemical relation that the quantity of cathodic element liberated is simply that which was chemically combined with the quantity of anodic constituent liberated, and is only thus indirectly related to the quantity of electric current passing.

Messrs. HERING, MADSEN and LANDIS participated in the discussion and it was generally conceded that Dr. Richards' interpretation of Faraday's law was an excellent one, although perhaps not entirely new.

### Saturday's Technical Session

The third technical session was held Saturday morning and was devoted to papers on electrolytic refining, electroplating and corrosion. In the electroplating art considerable attention has been paid to brass plating and remarkable results have been achieved within the last few years.

#### ELECTRODEPOSITION OF BRASS FROM CYANIDE SOLUTIONS

After discussing the theory of the co-deposition of two metals from solution, ALFRED L. FERGUSON and EARL G. STURDEVANT presented the results of a series of experiments upon the deposition of brass from cyanide solutions. Cast zinc and electrolytic copper anodes were used so that the single potentials of each metal could be determined. The following conclusions were noted:

Increase in the ratio of copper to zinc in the solution increases the percentage of copper in the deposit. A solution in which the ratio of copper to zinc is 4.2 gives a deposit of about 65 per cent copper (ratio 1.9). Solutions of high metal content are more satisfactory than dilute solutions. A solution containing 35 g. of metal per liter, in the above ratio, gives satisfactory deposits. Increase in temperature decreases cathode polarization and consequently increases the percentage of copper in the deposit. Increase in current density produces a gradual decrease in the percentage of copper in the deposit. At current densities greater than 0.3 amp. per sq.dm., the deposit becomes granular, non-adherent and dull in color. Increase in free cyanide does not increase anode efficiency, but does decrease cathode efficiency. Its influence on the percentage of copper in the deposit is variable.

Slightly acid substances increase the percentage of copper in the deposit. A weak acid may be used in place of any of the acid substances that have been recommended. Slightly alkaline substances decrease the percentage of copper in the deposit. The presence of slightly alkaline substances is beneficial in that it improves the appearance of the deposit. Neutral substances have no influence on the deposit of the cyanide brass plating solution.

Brasses which vary in composition from 62.3 to 85.0 per cent of copper dissolve as such anodically. The efficiency of corrosion is about the same as that of copper. Decided depolarization of zinc by copper takes place and makes possible the deposition of brass from solutions in which the potentials of the two metals are not equal. Electrodeposited brasses which vary in composition from 37.6 to 82.0 per cent copper give nearly the same potentials in a plating solution. These potentials are nearer to that of copper than to that of zinc.

Mr. HOGABOOM dwelt at length upon the importance of controlling and regulating conditions during deposition of brass. He has developed a commercial process for coating steel and iron with brass and the results

are so good that it is practically impossible to distinguish the brass plated articles from those made of solid brass. Dr. BLUM of the Bureau of Standards criticized Dr. Sturdevant's thesis from the theoretical point of view. He did not concur with him in all of his conclusions.

#### TIN PLATING FROM ALKALINE TIN BATHS

FRANK C. MATHERS and WILLIAM H. BELL discussed the possibility of producing smooth non-crystalline deposits of tin from sodium stannite baths by the use of addition agents. Although it was found that balsam copaiba and rosin gave good deposits, the experiments were unsuccessful in that the sodium stannite baths gradually oxidized or deteriorated to such an extent that continued satisfactory deposits could not be obtained. No method of regenerating the baths was found. For this reason, the bath is not recommended for tin plating. It would be unreasonable to bother with sodium stannite when one can use the stannous sulphate bath, which gives splendid deposits without any important difficulties.

Although the authors did not pass favorably upon the alkaline bath for tin plating, Mr. HOGABOOM, in discussing the subject, related his success with the bath at one of the Government plants. He used an electrolyte containing stannic chloride and sodium hydrate and obtained excellent results. The plate was very smooth and adhered perfectly. Of course only thin deposits were required. Messrs. FINK and MADSEN referred to misleading statements in the literature as to the rating of a plating bath. It was suggested that hereafter authors include the limiting phrase such as "for heavy plates" or "for thin plates" in passing upon the quality of a plating bath. The tin chloride electrolyte gives good thin deposits but very loose crystalline heavy deposits.

#### ELECTROLYTIC REFINING OF TIN

EDWARD F. KERN presented the results of a series of experiments on the electrodeposition of tin. The electrolytes used were stannous-sodium chloride, stannous fluoborate, stannous naphthalene-sulphonate and stannous sulphate.

When no addition agents were used, the best cathode deposits were obtained from a stannous sulphate solution containing 6 g. tin and 7 g.  $H_2SO_4$  per 100 c.c. The deposits formed in stannous naphthalene-sulphonate electrolyte (made from the corresponding copper solution by replacement with tin) were second best; and the deposits from stannous-sodium chloride electrolyte and from stannous fluoborate electrolyte were third best. In no case were adherent, smooth cathode deposits formed, with no addition agent present.

In order to produce satisfactory cathode deposits of tin in the electrolytic refining of tin, it seems to be necessary to add suitable addition agents to the electrolyte. It was found that the presence of peptone and of gelatine was beneficial; the presence of aloin was beneficial only with the fluoborate electrolytes when present in proportion of 1 g. per 1,000 c.c. solution. The most satisfactory cathode deposits were formed in the stannous fluoborate and in the stannous sulphate electrolytes when gelatine or peptone was present in the proportion of 1 g. per 500 to 1,000 c.c. of electrolyte. In the case of the sulphate electrolyte, the best cathode deposits were formed when the solutions contained 5

or 7 g. free  $H_2SO_4$  per 100 c.c.; more than 2.5 g. free  $H_2SO_4$  per 100 c.c. solution seems to be necessary. The presence of free acid over 2.5 g. per 100 c.c. keeps the solution clear, and prevents the precipitation of basic salts, which if allowed to collect on the cathode deposit cause the tin to form non-adherent, large crystals. The cathode deposits formed from the stannous sulphate electrolyte containing 5 and 7 g. free  $H_2SO_4$  per 100 c.c. were as satisfactory as those formed from stannous fluoborate electrolyte.

Heating the electrolytes is beneficial in that the potential drop between the electrodes is reduced, and also a more adherent deposit is formed. Raising the temperature increases the effectiveness of the addition agent; a smaller amount of addition agent being required.

Dr. KERN's paper aroused a good deal of discussion. Prof. MATHERS dwelt at length upon the importance in the selection of the addition agent and suggested that Dr. Kern include in his paper a table of costs of addition agent per ton of tin deposited. A number of addition agents suggested by the author were too high priced for a refinery. Dr. LANDIS referred briefly to the large tin-refining plant at Perth Amboy, emphasizing the fact that electrolytic tin had long since passed beyond the purely experimental stage.

#### LEAD PLATING FROM SODIUM HYDROXIDE LEAD BATHS

The effect of addition agents in restraining the crystalline structure of the cathode deposits in alkaline lead baths was studied by FRANK C. MATHERS. Gum sandarac, gum galbanum and oleic acid were found to be very satisfactory, while other gums, rosins and fatty acids showed marked beneficial influences.

A satisfactory concentration of bath was found to be:

	Per Cent	Oz. per gal.
Crystallized lead acetate.....	7.3	9.7
Sodium hydroxide .....	20	27
Addition agent .....	0.3 to 1	0.4 to 1.32

As high a temperature as possible should be used. Better deposits are obtained at 90 deg. C. (194 deg. F.) than at 80 deg. C. (176 deg. F.). The current density at the anode should not be greater than 1 amp. per sq. dc. (9.7 amp. per sq. ft.). A cathode current density of 1.5 to 2 amp. per sq. dc. (14.1 to 18.8 amp. per sq. ft.) can be used, but the lower the current the better the deposit. At these current densities, the corrosion and deposition are approximately 100 per cent. The deposits are not as perfect as those from the acid lead baths, hence they are less satisfactory as protection against sulphuric acid.

In the discussion that followed, the early experiments of ANSON G. BETTS were referred to and it was suggested that, since our knowledge of electrolytic refining of metals had advanced rapidly within recent years, it would well repay the research men to repeat Mr. Betts' experiments with a view to improve upon the fluosilicate electrolyte.

A general debate followed on the theory of addition agents. Dr. FINK briefly reviewed the protective colloid theory and the colloid-electrolyte complex theory. Dr. BLUM recited a number of experiments in support of the protective colloid theory. Dr. HERING described tests he had carried out under the microscope. There seemed little doubt in his mind that the colloid particles were attracted to (or by) the points of the cathode crystals, necessitating a new direction or location of the next crystals. In one of his experiments he intro-

duced into the electrolyte both a positive and a negative colloid as addition agents. He expected the positive particles to collide with the negative particles, but under the microscope no such collisions could be detected. Dr. BLUM emphasized the importance of taking into account the relatively high current density at the points of the crystals. Dr. FINK suggested that further experiments be carried out with diaphragm cells, putting the addition agent in the cathode compartment and none in the anolyte; also reversing the procedure and putting the addition agents in the anolyte.

#### ELECTROLYTIC PRODUCTION OF HYDROGEN PEROXIDE

The literature on electrolytic hydrogen peroxide was briefly reviewed by F. W. SKERROW and E. R. STEIN before introducing their results on the experimental decomposition of sulphuric acid, sodium or potassium acid sulphate solutions. The current efficiencies with which persulphuric acid was formed were about the same in all three solutions. Of the materials experimented with as anode material, platinum was the only one offering possibilities of success, with the possible exception of manganese dioxide. Sodium persulphate solutions can apparently be produced to a much higher concentration than can persulphuric acid, without sacrifice of current efficiency. The potassium salt is, of course, obtained in solid form. Distillation of once recrystallized potassium persulphate with sulphuric acid and water gives reasonably high yields of hydrogen peroxide. Distillation of persulphuric acid or sodium persulphate solutions would need to be preceded by extremely rigorous purification to remove catalytic impurities.

#### INFLUENCE OF COPPER, MANGANESE AND CHROMIUM ON CORROSION OF THEIR IRON ALLOYS

Extensive data were presented by E. A. and L. T. RICHARDSON showing that there is a mutual action between manganese and copper in their effect upon the atmospheric corrosion of iron. Copper alone reduces the corrosion of pure iron and, to a still greater extent, the corrosion of steel. This is due to the effect of manganese, which enhances the effect of copper. If manganese is replaced by chromium, the effect is still more pronounced. It is shown that the red-short range in iron, due to the presence of copper, is removed by either manganese or chromium. It is believed that there is some relation between this red-short range and resistance to atmospheric corrosion. Based upon this, the film or inter-grain hypothesis is suggested to explain the corrosion resistance of these alloys.

Mr. AUPPERLE attacked the conclusions drawn and felt convinced, on the basis of his experience, that copper had no beneficial effect and did not prevent corrosion. Dr. RICHARDS took exception to the author's statement that "it has been known for years that commercially pure iron is red-short . . . and this red-shortness is due to copper." But Mr. Richardson maintained that every sample of commercially pure iron analyzed was found to contain copper. Dr. FINK pointed out that the presence of copper in the interfaces would depend to some extent upon the relative proportion and distribution of other impurities, such as sulphur or carbon in the iron samples. It is well known that the solubility of copper in iron is greatly influenced by such impurities. Accordingly, two samples of iron may con-



tain the same quantity of copper and yet the corrosion rate of the two be entirely different. Further metallurgical investigations are needed.

#### SOLUTION OF METALS IN ACIDS

Inconsistent behavior of the metals in corrosion and acid solution phenomena on the basis of the electrochemical series were explained by W. D. RICHARDSON, who took into consideration a number of factors of which the principal were: solution tension, the hydrogen influence, the oxygen influence, the carbon dioxide influence, the cathode influence and the halogen influence.

Corrosion and solution of metals in acids may be considered as actions tending to go forward at rates proportional to solution tension and hydrogen ion concentration, but subject to the accelerating and retarding influence of many substances acting as catalysts. Indications of the sensitiveness of various metals to the hydrogen and oxygen influences can be obtained by

The rates of solution of copper-bearing and pure open-hearth iron in nitric acid are catalyzed negatively by silver, copper and formaldehyde, but the rates of gray cast iron and semi-steel are catalyzed positively by the same three catalysts. No pronounced change of rate is shown by silver, copper or formaldehyde acting as catalysts on copper-bearing or pure open-hearth iron in sulphuric or hydrochloric acid. The same is true for silver and copper when acting on gray cast iron and semi-steel, but in contrast with this behavior, formaldehyde catalyzes these metals strongly in a negative direction in the non-oxidizing acids.

Platinum catalyzes the rates of copper-bearing and pure open-hearth iron positively in normal sulphuric and hydrochloric acids, and the action is more pronounced in the case of pure open-hearth iron than in the case of copper-bearing iron. On the contrary, the rates of these metals in normal nitric acid are catalyzed negatively by platinum. The rate for copper is not certainly catalyzed by any of the catalysts used. Nickel as a



Photo by C. J. Murphy, Cleveland, Ohio

BANQUET OF AMERICAN ELECTROCHEMICAL SOCIETY AT HOTEL STATLER, CLEVELAND, FRIDAY, OCT. 1, 1920

their behavior when treated as couples in dilute acids and neutral salts and connected through a sensitive voltmeter or galvanometer.

Studying the behavior of metallic catalysts on the rates of solution of copper-bearing iron, pure open-hearth iron, gray cast iron and semi-steel in normal sulphuric, hydrochloric and nitric acids at 16 deg. C., with several metallic catalysts, it was found that the rolled metals in general showed a different and opposite behavior to that of the cast metals.

Again, the behavior of any of these metals in the non-oxidizing acids, sulphuric and hydrochloric, is as a rule different from the behavior in nitric acid. A similar rule holds for these metals in corrosion and also for solution in the above acids without catalysts. Although the mode of action of a soluble organic catalyst, such as formaldehyde, is probably different from that of the metallic catalysts, nevertheless the opposite tendency in the case of different metals in oxidizing and non-oxidizing acids is revealed in this case also.

catalyst produces no effect on any of the metals in any of the acids except aluminum in hydrochloric acid. Aluminum is not affected by any of the catalysts in nitric or sulphuric acid. In normal hydrochloric acid the rate for aluminum is catalyzed strongly by nickel and still more strongly by platinum. A similar action might be expected in sulphuric acid and the lack of action in this case is probably due to the oxygen influence of sulphuric acid on aluminum.

Under conditions of corrosion the cast metals are relatively less attacked in the presence of much oxygen than the purer rolled metals. They are also relatively less attacked by an oxidizing acid, such as nitric, than by the non-oxidizing acids, sulphuric and hydrochloric. The catalysts, silver, copper and formaldehyde, all reverse this action and cause the rates of the cast metals in nitric acid to be increased and the rates of the copper-bearing and pure open-hearth irons to be reduced. Platinum, while catalyzing the rolled metals negatively in nitric acid, catalyzes them positively in sulphuric and hydrochloric acid, and is without action

on the cast metals in any acid. The failure of platinum to catalyze the cast metals is probably due to the evolution of poisons from the impure metals by the action of the acids.

After a brief discussion the members adjourned for luncheon in the rooms of the Cleveland Engineering Society.

### Visits to Industrial Plants

Under the very able guidance of the chairman, Dr. N. K. Chaney, and W. R. Mott, a number of interesting visits were made to neighboring laboratories and factories. At the plant of the National Malleable Castings Co. the points of special attraction were the large Heroult steel furnaces, the malleabilizing process, the method of casting chains, the Baily electric heat-treating furnace and the pulverized coal plant.

At the Guide Motor Lamp Mfg. Co.'s plant copper, silver and nickel plating vats were in operation. This is a new plant and a number of improvements, such as rotating cathodes, have been installed. The last plant visited Thursday afternoon was that of the U. S. Copper Products Co. Here an opportunity was offered to see a G.E. smothered arc furnace, for brass melting, in operation. Alongside of this was a Baily brass furnace casting ingots about 3 ft. long and 3 in. in diameter. These ingots were subsequently forced over mandrels and drawn into tubing.

On Friday afternoon an elaborate visit was arranged to Nela Park. A number of the laboratories were taken in and with the aid of moving picture films the many intricate steps involved in the manufacture of the tungsten lamp, from ore to finished product, were explained. Opportunity was afforded to see the red hot tungsten wire being drawn through diamond dies, also assembling of the various lamp parts into the finished "Mazda."

Dr. ERNEST FOX NICHOLS, director of pure research at Nela, addressed the Society on "The Value of Research in Pure Science and Its Relation to Industry." It will be recalled that recently there has been a reorganization of Nela Research Laboratories into two sections, one of applied and the other of pure science. It is the latter which is under the direction of Dr. Nichols, formerly president of Dartmouth College and more recently professor of physics at Yale University. The speaker showed how science first came into industry through the testing of raw materials and final products. This was followed by industrial research, and this in turn by pure science research. The aim and purpose of the latter, he explained, are the extension of the boundaries of our knowledge, providing data of a fundamental nature which industrial research applies to the improvement of the product and reduction of its cost. Research in pure science, therefore, may go far afield, and sometimes a long period will elapse before the knowledge thus gained is used. In general, however, the time lag between a fundamental scientific discovery and its industrial application is becoming shorter and shorter. The pure scientist is being pushed by the industrial researcher. It is recognized, of course, that immediate profits come from industrial research, while the longer deferred dividends come from research in pure science. In the opinion of Dr. Nichols it is not only advisable for industry to give more attention to pure research, but it is a duty which it should assume in order that its service will be more efficient.

On Saturday afternoon the members visited the

Hazelett Storage Battery Co. Mr. Hazelett demonstrated his novel method of making very thin lead plates by casting the metal on a revolving drum. The plates obtained are decidedly thinner than any others heretofore produced for battery purposes and accordingly the ampere hours per unit weight of battery are far in excess of those of older types.

A trip through the factory of the Western Reserve Chemical Co. was arranged by Mr. Burwell, general manager of the plant. Phthalic acid was produced in large quantities by the oxidation of naphthalene with chromic acid. A novel electrolytic cell arranged in cascade was demonstrated; this was used for the regeneration of the spent chromic acid. The cost of making phthalic acid and benzoic acid is lower than by other processes.

E. S. MacPherson conducted the members of the society through the "gas factory" of the Ohio Chemical Co. It was one of the most attractive plants visited. Four gases were being turned out: oxygen, hydrogen, laughing gas and carbon dioxide. The electrolytic plant consists of one of the very first Levin cell installations. The oxygen analyzes 99.8 per cent pure. Neither the oxygen nor the hydrogen requires purification after leaving the cells. The carbonic acid is made from magnesite by a new process.

### Canada's Paper and Pulp Exports

According to statistics issued by the Dominion Government, Canada's pulp and paper exports for July were valued at \$16,014,747, as compared with \$7,730,162 for the corresponding month a year ago, an increase of \$8,284,585, or more than 100 per cent. The shipments were made up as follows:

	Month of July	
	1919	1920
Paper	\$4,639,225	\$6,877,014
Chemical pulp	2,654,333	6,608,740
Mechanical pulp	436,604	2,528,993
Total	\$7,730,162	\$16,014,747

The paper exports during July, which included 9,789 cwt. of book paper, valued at \$110,596, and 1,219,439 cwt. of newsprint, valued at \$5,727,193, went to: United States, \$5,535,386; United Kingdom, \$425,949; other countries, \$915,679.

Exports of unmanufactured pulp wood show an increase in both volume and value for the month of July. They were: 1919—122,069 cords, value \$1,234,527; 1920—144,721 cords, value \$1,545,906.

### APRIL-JULY SHIPMENTS

For the first four months of the current fiscal year Canada's pulp and paper exports reached a value of \$52,494,052, as compared with \$27,067,236 in April-July, 1919, a gain of \$25,426,816. They were greater by \$5,966,784 than the value of such exports in the complete year 1916-17—up to that time a record. Details of the four months' period follow:

	April-July	
	1919	1920
Paper	\$17,532,409	\$26,423,354
Chemical pulp	7,903,626	20,118,759
Mechanical pulp	1,631,201	5,951,839
Total	\$27,067,236	\$52,494,052

In April-July, 1920, the paper exports (which included 24,751 cwt. of book paper, valued at \$259,886, and 4,906,188 cwt. of newsprint, valued at \$21,916,549) went to: United States, \$20,998,774; United Kingdom, \$1,548,102; other countries, \$3,876,578.



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## Legal Notes

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BY WELLINGTON GUSTIN

### Palmer Potash Products Co.-Nebraska Potash Works Co. Controversy

The Supreme Court of Nebraska has affirmed the judgment in the controversy involving the Palmer Potash Products Co. and the Nebraska Potash Works Co. and others, except as to the amount of recovery, \$120,000. The court found no satisfactory basis for arriving at these figures and directed the lower court to have another accounting made.

Plaintiff's Clay and Irwin are members of the partnership called the Palmer Potash Products Co., each owning a one-third interest; Palmer owned the remaining interest. Palmer had purchased 1,240 acres of land in Sheridan County, Neb., on part of which were two lakes, the waters and underlying soil of which contained potash. Shortly after this purchase the partnership was formed for the purpose of producing potash from the waters and deposits of part of the larger lake, known as Ashburger Lake. It was contended that Palmer made an oral lease to the partnership for the term of twenty years to the southern part of the lake, with the right to remove and appropriate all the potash and other minerals in the lake and underneath the same. The lease further conveyed the right to use sufficient ground near the lake north of this lease for the necessary buildings, tanks and machinery, and for a right of way across the tract to the C. B. & Q. R.R. and for other necessary buildings and sidetracks. Palmer was to be paid a royalty of one-eighth of the proceeds of the potash produced. The oral lease is referred to in the partnership agreement, but this instrument does not provide for a 20-yr. limit to the lease nor for its own termination as agreed upon, and it further lacked definiteness as to the premises leased.

#### LAND SOLD AND ANOTHER LEASE MADE

After the execution of the agreement the partners constructed buildings and improvements on the margin of the lake and began extracting potash. In a somewhat crude manner, it was found, they extracted about thirteen tons of potash before lack of capital and dissensions between them prevented operations. The partners attempted to interest others who could provide necessary capital to make the payment upon the land coming due under Palmer's contract of purchase. Palmer finally assigned his interest in the land to Dr. Copsey of Alliance, Neb. It was alleged that Copsey bought the land from Palmer with full notice and knowledge of the partnership rights, and executed a lease to the lake to the Nebraska Potash Works Co., which also had full knowledge of plaintiffs' rights.

The plaintiffs brought suit to re-form the partnership agreement so as to show that the term of the partnership and the term of the lease should each be for twenty years, and when re-formed that the contract be specifically enforced and the defendants be enjoined from interfering with the use and occupancy of premises by the partnership and that title be confirmed and quieted in said partnership.

Defendants, the Nebraska Potash Works Co., Dr.

Copsey, Palmer and others, answered, claiming the written agreement between Palmer and his copartners was the only agreement made between the parties, denying the lease was for twenty years and alleged abandonment of the enterprise by the partnership. The cause was then removed by defendants from the state courts to the Federal court, but was afterward sent back from the Federal court. During this time the company sank wells in the lake and began pumping water and extracting potash.

In a supplemental petition the plaintiffs alleged in addition that Palmer was still the owner of the land; that the company had taken out from twelve to thirteen tons of potash per day, of the value of \$136 per ton; that the company had sunk over 400 wells in and about the lake, and that the partnership was indebted and that Palmer refuses to contribute his share in payment. The plaintiffs then asked that the lease of the company be canceled; that it be restrained from operating upon the premises; that the title be quieted in the partnership; that an accounting be taken of the potash extracted and the amount with interest be paid over to the partnership.

The trial court found that plaintiffs were entitled to all their claims and gave a judgment for \$120,000 with interest as damages sustained, caused by the trespass of defendants.

#### LOWER COURT UPHELD

The Supreme Court has upheld the lower court, except as to the amount of the damages, finding there was not proper basis for determining this amount. It found that Copsey and the company had full knowledge of all the rights claimed by the partnership and therefore whatever rights they have acquired with such knowledge are subject to the rights of the partnership.

The agreement set forth in the opinion considered in connection with other evidence in the case the court held to be more than a mere license to extract potash and to confer upon the lessees the exclusive right to occupy the leased premises and remove potash.

The facts showed that the distribution of potash in waters of the lake was by no means uniform, presumably for the reason that evaporation proceeds as the waters move southward. The natural drainage is toward the south or southeast and the waters in the south end of the lake are much the richer. Defendants first confined their operations to that portion of the lake north of the dividing line, later invading the southern portion on the premises of the plaintiffs.

The court found that the evidence did not show abandonment by the lessees at the time defendants entered and removed mineral-bearing water from the leased premises.

Defendants contend that operations of the partnership were not interfered with and that there was no force used in the occupation of the south part of the lake, but the court says it seems obvious that the taking of actual possession and sinking of over 400 wells by the company in the south portion of the lake would effectively interfere with the raising of capital by the partners and the successful prosecution of their enterprise. It is true that if let alone the parties might have been forced to abandon their lease and thus lose all their rights, said the court, but as long as it was in existence no one had the right to interfere with them.

The question of its proper measure of damages gave the court much trouble. The general rule is that where

one having knowledge of the rights of another willfully trespasses upon and takes his property the owner is entitled to follow and recover it, even though its condition may have been changed and value added by the wrongdoer. On the other hand it was said if the taking had been under an honest mistake of fact and with no wrongful intention on the part of the trespasser the owner is entitled to recover only its value in its natural state.

Following the latter rule, in remanding the case to determine the proper damages, the court directs the ascertainment of the proportion of potash derived from the southern portion of the lake as near as possible; to charge Copsey and the company with the net proceeds of all potash derived from the same, less the royalty of one-eighth and the cost of extraction after the water was in the pipe line.

### **Buyer and Seller Held in Default Where Shipment Is Prevented by Embargo**

The Appellate Division of the Supreme Court of New York has reversed judgment of the lower court in the action brought by Miller & Sons Co. against the E. M. Sergeant Co. and directed judgment for the latter.

The action arose out of a sale of twenty-four carloads of about 50,000 lb. each of Solvay brand 58 per cent light soda ash to the Miller company, for shipment in two installments each month, price f.o.b. Solvay, N. Y. There was a provision that default in any payment by the buyer gave the seller the right to cancel any undelivered portion of the contract.

The Government having possession of the railroads and having laid an embargo on freight, shipment deliveries for January, the first month of the contract, became practically impossible. The seller wrote buyer to get a special embargo permit from the Government, which the buyer failed to obtain upon application. The embargo was lifted Feb. 16, and the buyer then wrote the seller to ship immediately all soda ash due. The seller, in response to this, shipped two carloads due for February, but declined to ship the January installment upon the ground that having offered to deliver the two carloads in that month, and the buyer having failed to take the same, the shipper could not be required to deliver that installment in any other month.

Damages for failure to deliver the two cars in January were asked. The trial court adopted the contention of the buyer that the seller failed to deliver the two cars due under its order, that delivery was to be made in Philadelphia, where the buyer's plant was located, and that the words "f.o.b. Solvay, N. Y." were an element of the price and merely meant that the buyer was to pay the freight.

#### **WHAT THE TERM F.O.B. MEANT**

The higher court held that the words "f.o.b. Solvay, N. Y." did not have reference to the place of delivery, but held the place of delivery was not at the buyer's place of business in Philadelphia. It said the contract was silent as to the place of delivery, and where that is the case the store or factory of the seller or the place where the goods are kept is the place of delivery.

The buyer claims that it was the duty of the seller to deliver a total of twenty-four cars, and if because of contingencies beyond its control it could not make the delivery the buyer was entitled to require delivery at a later date when delivery was possible. But the court said the contract was not an entire contract for the sale

of twenty-four carloads, but was for the sale of twenty-four carloads in two installments each month, for which payment was to be made on each installment. Therefore it said the contract was severable and under the common law the failure of one of the parties to tender delivery or to pay for an installment would entitle the party to rescind the entire contract. If the parties thereafter proceeded under the contract the right to rescind would be lost. This rule is now changed in New York State by the personal property statute so that it depends in each case on the terms of the contract and circumstances whether the breach "is so material as to justify the injured party in refusing to proceed further and suing for damages for breach of the entire contract, or whether the breach is severable, giving rise to a claim for compensation for any loss, but not to a right to treat the whole contract as broken."

As might have been done, neither party sought to excuse its failure because of contingencies beyond its control; in fact, each claimed the other failed to perform, there being no failure on their own part. The sole remaining question is which party did fail to perform. It being found that Solvay, N. Y., was the place of delivery, when the seller notified the buyer that the goods were ready for delivery and asked buyer to secure embargo permit for shipping, the seller performed, and the failure of the buyer to accept the delivery was a breach of the contract on its part. Therefore it has no claim for the January installment and judgment was directed against it.

### **Where Buyer May Not Enforce Contract for Deliveries**

In a recent decision of the Supreme Judicial Court of Massachusetts in the case of Lionel Samuels against the W. H. Miner Chocolate Co. the court holds that the buyer had broken the contract by omitting to forward his check and to send orders, which justified the seller's cancellation of the contract.

The contract was for the purchase and delivery of 2,000 bbl. of cocoa at 11½c. per lb., to be shipped by the chocolate company at such times and in such amounts, not to exceed 100 bbl. per week, as the buyer should direct. The buyer was not obliged to draw each and every week or at any particular time. The whole 2,000 bbl. was to be ordered shipped during the year 1917, and payment for each shipment was to be made in advance.

There was some delay on the seller's part in shipping during July and August. But this delay was waived by the buyer. In September the buyer made excuses for not ordering, and the latter part of said month the seller notified the buyer to furnish the orders under the contract or same would be canceled, and finally in October the seller canceled the contract.

When the contract was canceled there remained but eleven weeks of the contract period, with 1,485 bbl. unorderd, and the buyer was not obligated to ship more than 100 bbl. per week. Now, in addition to this failure to send orders as required by the contract there was a further neglect on the buyer's part to comply with the agreement by his failure to forward a check for each lot before shipment was made.

The court found that buyer's breach in these matters went to the essence of the contract and that it justified the seller in canceling the rest of the order. The judgment of the lower court was upheld.





## The Channel Process of Making Carbon Black

Details of Plant Construction for Channel Process—Condensing Building—Gas Transmission  
—Channels—Hoppers, Scrapers and Conveyors—Burners—Driving Mechanism  
and Accessories

BY ROY O. NEAL

**I**N COMMERCIAL practice there are four different processes of manufacturing carbon black from natural gas—viz., the channel system, the small rotating disk, the roller or rotating cylinder, and the large plate processes. The main points of difference in these methods is in the size and shape of the surface upon which the carbon is collected and the rate at which the moving devices actuate. The channel process is probably the best method and is the most extensively used. Classified according to the quantity of carbon black produced, the order is as follows: Channel, small rotating disk, large plate, and roller processes. At the present time the production of carbon black by cracking or thermal decomposition methods is not extensive.

### THE CONDENSING BUILDINGS OF THE CHANNEL PROCESS

The buildings in which the channels and burners are installed are made of 24-gage sheet iron, held by wire to a steel frame made of  $\frac{1}{2} \times 1\frac{1}{2} \times 1\frac{1}{2}$ -in. angle iron. Fig. 1 shows the structural details of a typical building (sometimes referred to as the condensing building). The ridge piece does not extend the entire length of the building, as spaces are left to allow the escape of the gases of combustion. The ridge pieces are flexibly attached so that spaces can be changed, and consequently the draught regulated. In the design of some plants chimneys are provided. Slits or slide doors are located along the bottom of the buildings for controlling the air entering the buildings, but usually are not adjusted to meet the various weather conditions. A door at each end and one or two doors on both sides furnish access to the interior of the condensing buildings. With buildings having one table—that is, buildings that have one

group of channels bolted together—the dimensions are 8 or 10 ft. in width by 80 to 115 ft. in length. With two-table buildings, the dimensions vary from 18 to 20 ft. in width and from 80 to 115 ft. in length.

The buildings are arranged in parallel rows at right angles to and on both sides of an alley. The alley-way is about 15 ft. wide and buildings are from 3 to 5 ft. apart. The number of one-table buildings per unit—that is, whose power is furnished by one engine—varies from 24 to 30. In some districts, particularly Louisiana, a larger yield has been obtained with one-table buildings on account of the atmospheric temperature. With two-table buildings, the number of buildings per unit varies from 12 to 16. The units have a capacity ranging from 60 bbl., or 3,000 lb., to 100 bbl., or 5,000 lb. of carbon black per day. The largest plant that the writer inspected was made up of six units and consequently had six packing houses, six engines for furnishing power and six main driver shafts. The entire plant consisted of 180 condensing houses.

### GAS TRANSMISSION

The gas coming from the wells, discharge from gasoline plant or gas transportation mains, is reduced in pressure by suitable regulators. After passing through the regulator the gas goes through a gasometer tank that is partially filled with water. Details of a typical gasometer are shown in Fig. 2. It consists of two tanks made of boiler plate, one inverted in the other. The gas is passed into the inverted tank and held by a water seal. The pressure of the gas blowing from the gasometer will be determined by the weights on top of the tank and the height to which it rises. The inverted tank is connected to a butterfly valve on the intake gas line by means of a lever arm, so that, as the pressure increases, the inverted drum of the gasometer tank rises

EDITOR'S NOTE.—The present description and others that will be published shortly are published by permission of the director of the Bureau of Mines in advance of the report of the Bureau.

and the butterfly valve is closed. The flow of gas is controlled by the gasometer so that the pressure of the gas upon discharge will have a pressure of less than 1 oz. per sq. in.

In a plant having one-table condensing buildings, the gas is piped from the gasometer tank to a 24-in. distribution pipe made of riveted boiler plate, which lies in the center of the alley. Two 4-in. lines connect the distributor to each building, each of which is provided with a 4-in. gate valve. In the buildings a 1½-in. pipe is connected to a 4-in. line every 8 ft. Between the 1½-in. pipes a 1-in. rod or riser 3 in. high is welded, upon which the overhead channel work is supported. This arrangement is shown in Fig. 4.

In another design, an 8-in. gas line completely encircles the condensing buildings, to which two 4-in. inlet pipes are connected at each end of the building. Fig. 3 shows an installation of this description. The method of piping in all cases must be capable of distributing the gas evenly throughout the entire unit, and the fact that the gas is held under such low pressure demands considerable attention.

The channels upon which the carbon black is deposited

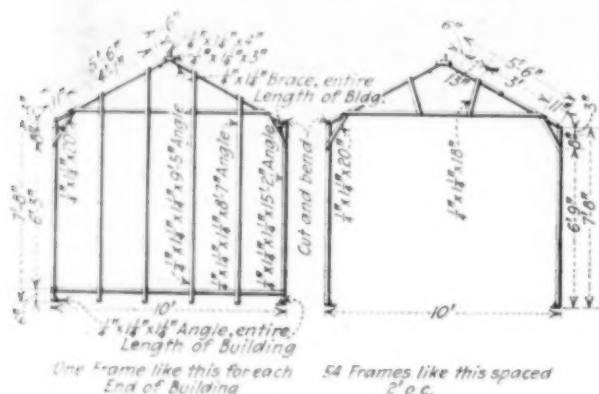


FIG. 1. DETAILS OF CARBON BLACK CONDENSING PLANT

are made of mild steel, 7 to 8 in. wide and weighing about 12½ lb. per linear foot. The channels are supported by trucks that run on overhead rails. The channels, trucks, rails and other accessories are held up by 1½-in. standard pipe that rests either on concrete piers or upon the gas-distributing pipes. An upright pipe is provided at approximately every 4 ft. They are stabilized by 1 x ½-in. cross-strap iron braces.

At the top of each upright support is placed a small cast-iron rail chair which carries the rails. The rails are made of steel weighing from 16 to 20 lb. per yd. Running on the rails are 10-in. double gudgeon truck wheels. The wheel has lugs projecting out from the axis on each side which regulate its position, and it is held rigid longitudinally by two short lengths of 2 x 2-in. angle iron, although it can oscillate within a fixed distance in the line of direction of the rails.

Attached to the angle iron on both sides of the truck wheel are transverse channel beams (6½ lb. per ft.), to which the channels upon which the carbon black is deposited are bolted. Most of the plants have eight rows of channels on each trestle. These trestles are about 6 ft. wide and are called tables. An installation of this type is shown in Figs. 5 and 6, the views having been taken at a plant under construction. The channels are bolted together in lengths as great as 100 ft., while the trestle work is from 10 to 15 ft. longer to allow for the oscillations of the table.

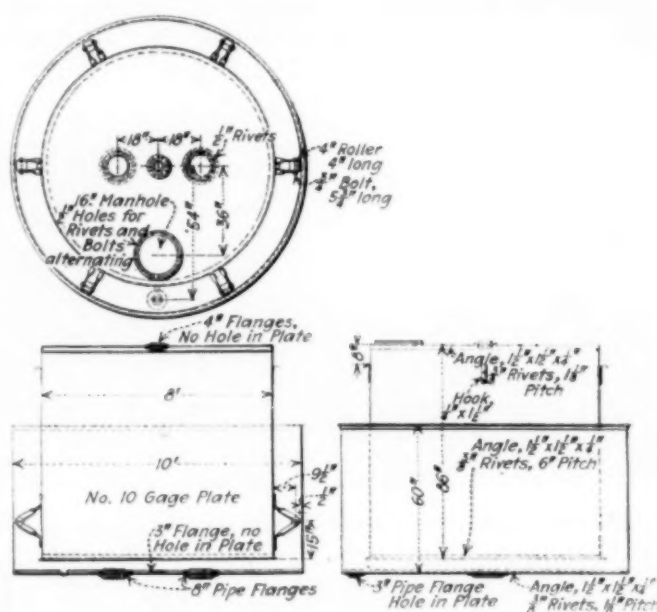


FIG. 2. DETAILS OF A GASOMETER TANK

Below the channels the carbon-collecting hoppers are located, being spaced approximately 4 ft. apart. The hopper is made up of three parts, the crown, body and base. The crown is supported upon the trestle by a ¼ x 1½ x 1½ in. angle on each side and sits loosely in the body, which is about 6 ft. in width in the upper portion and tapers down to about 10 in. The base is about 15 in. high and carries the conveyor pipe at its lower extremity.

All three parts of the hopper are 6 in. wide, and the crown contains four notches which retain the scrapers. (See Fig. 8.)

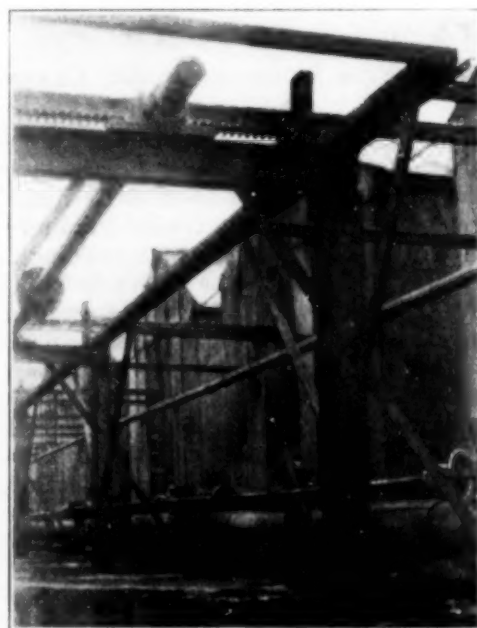


FIG. 3. MAIN SHAFT AND SUPPORTS



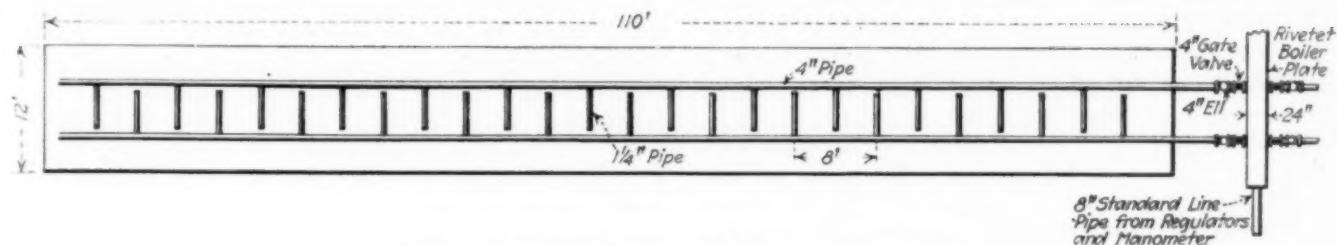


FIG. 1. PIPE ARRANGEMENT AND GAS DISTRIBUTION LINES

There are two classes of scrapers for removing the carbon from the channels—viz., those that operate continuously and those that are in direct contact with the channels while the tables are moving in one direction only. The latter is considered the best practice, since it gives a more uniform grade of black. The scrapers

ing buildings are made of galvanized sheet iron and are the spiral or screw type. The conveyor under the channels is 7 or 8 in. in diameter, the outside pipe being made of sheet iron throughout and crimped at one end of each section. The screw is usually made at the carbon plants by a simple tinner's machine which cuts disks of sheet

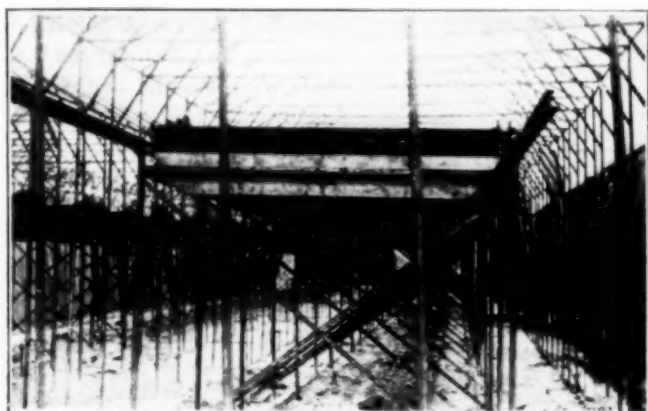


FIG. 5. CHANNEL PROCESS PLANT UNDER CONSTRUCTION

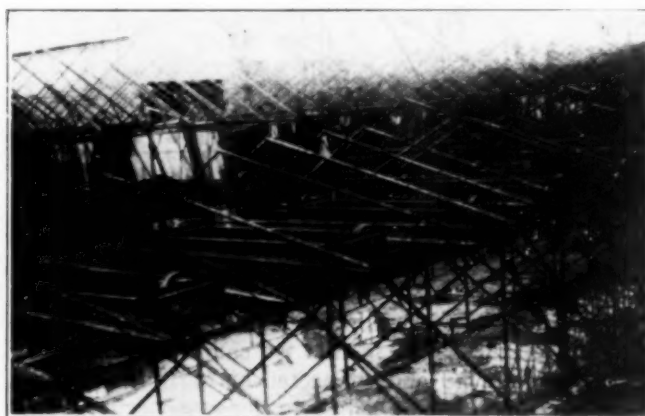


FIG. 6. UPPER VIEW OF CONSTRUCTION

are made of  $\frac{1}{2} \times 1\frac{1}{2}$  in. steel, being 8 to 11 in. in length, and have two blades that are attached to a 20-in. arm which carries a loop to which is attached a weight if the scrapers are to remove the deposited carbon continuously. With installations that remove carbon only while channels are moving in one direction, a system of levers is provided that is actuated by an automatic trip (referred to by the workmen as a "grasshopper"). Most plants are equipped with side scrapers for removing the carbon on the sides of the channel beams. A table having eight channels would have nine side scrapers over each hopper. The side scraper is made of a strip of strap iron  $\frac{1}{2} \times 32\frac{1}{2} \times 1$  in., which is bent in the shape of a narrow U tube having 15-in. legs and about a 2-in. arch. The upper ends, 3 in. from the uppermost extremity, are bent at right angles with the arched part.

#### CONVEYORS

The conveyors that connect the bases of the hoppers and that carry the carbon from the different condens-

ing buildings are made of galvanized sheet iron and are the spiral or screw type. The conveyor under the channels is 7 or 8 in. in diameter, the outside pipe being made of sheet iron throughout and crimped at one end of each section. The screw is usually made at the carbon plants by a simple tinner's machine which cuts disks of sheet

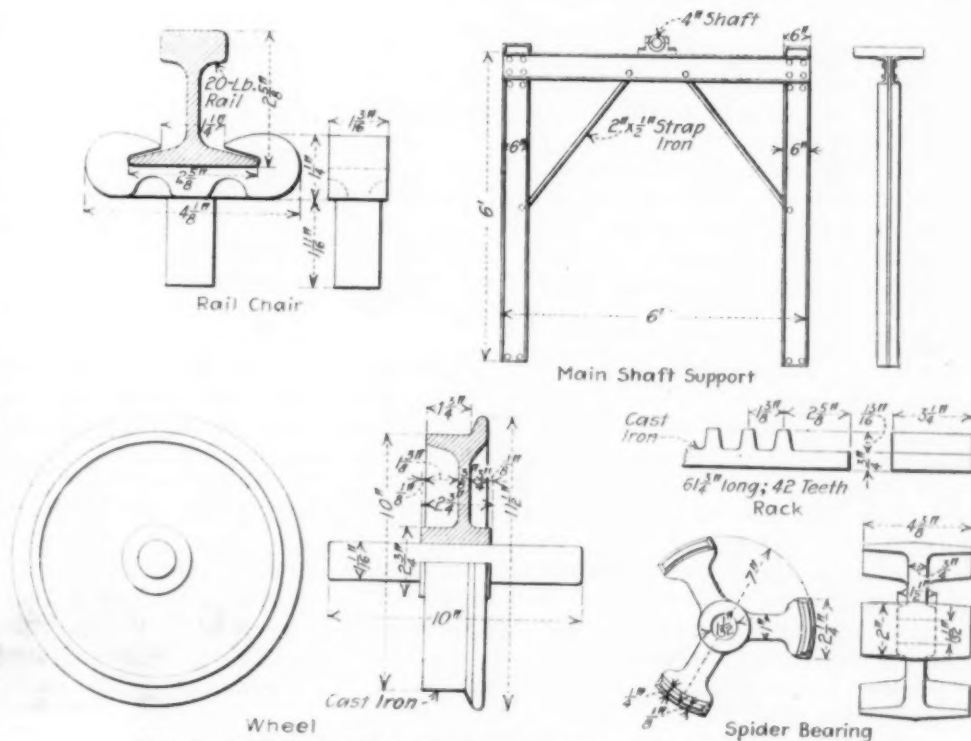


FIG. 7. DETAILS OF MACHINERY USED IN CHANNEL PROCESS

the shaft in helicoidal form and is held rigid by  $\frac{1}{2}$ -in. rivets. Fig. 7 shows the details of a spider bearing, truck wheel and rail chairs. Some carbon black operators prefer to purchase spiral conveyors from machine shops where helicoid is rolled from a single strip of metal before the pipe is inserted. This type of conveyor is strong, and resists to the full strength of the metal the lateral pressure due to pushing the material forward.

At the discharge end of each conveyor is an overflow

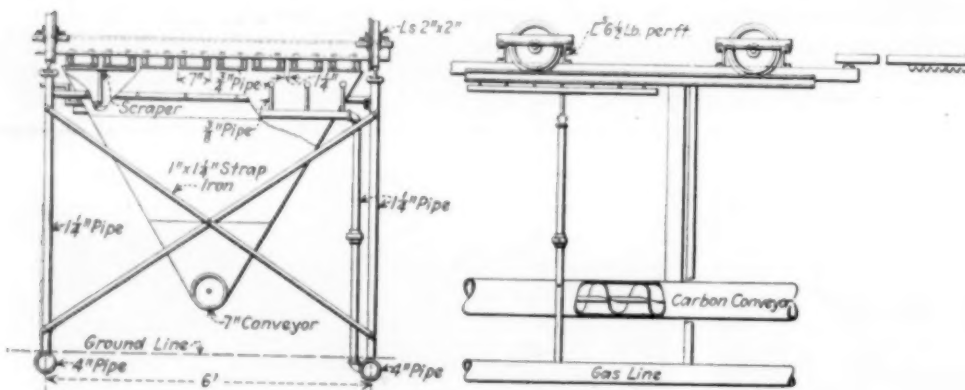


FIG. 8. ASSEMBLY DRAWING OF TABLE OF CHANNELS

tee which consists of a short pipe connected to the conveyor at a 30 deg. angle. This tee carries a sheet-iron cap. Below the tee and connected at a right angle to the conveyor is a pipe about 5 in. long and crimped at the end to allow the collected carbon to be transmitted to the main conveyors that lie on each side of the alley.

#### BURNERS

The space between hoppers constitutes one section of the trestle. In this space are located the burners. The gas is delivered to the section by a  $1\frac{1}{2}$ -in. pipe, to which is connected a  $\frac{1}{2}$ -in. pipe that carries the  $\frac{3}{4}$ -in. burner. The burner is parallel and about 3 to 4 in. below the channels. Each burner holds from eight to ten lava tips. A typical 60-bbl. plant would contain eight lava tips per burner, sixty-four lava tips per section, 1,600 lava tips per building, 38,400 lava tips per plant having twenty-four buildings.

The lava tips are made of a selected grade of steatite, that is easily machined in its green condition to any desired form by turning, milling and grinding. It is then heated to a temperature of about 2,000 deg. F., thus becoming hard and strong. Most of the manufacturers of lava tips are located in the vicinity of Chattanooga, Tenn.

There are a great variety of tips used, but the more common type burns 4 to 14 cu.ft. of gas per hr. The requisite for good tips is that they should produce uniformity of flame and have uniform gas consumption. A typical lava tip has a slot 0.20 in. deep and 9.934 in. wide. The lava tips are slightly tapered so that by drilling a hole slightly larger than its smallest outside diameter in the burner pipe, the tips can be securely held and made gas tight by the application of white lead. In Fig. 8 is given the general arrangement of burners, hopper, conveyors and channels.

Each unit is equipped with a separate engine which is usually about 20 hp. in capacity and is of the internal gas combustion, two-cycle type. Some factories use a simple steam engine, but instead of utilizing steam for

work, allow the high pressure gas before passing through the regulators to expand and furnish power for the expansion engine.<sup>1</sup> This arrangement effects an appreciable saving in the cost of operation. The engine is belt-connected to a drive shaft through which power is transmitted to the conveyors, elevators, bolting machines, packing machines and the reversing gear shift that actuates the channels. These details are shown in a plan view of a complete carbon black plant in Fig. 9.

A working drawing of a reversing gear shift is shown in Fig. 10. Power for the device is transmitted by a belt from the overhead drive shaft. Pulley *d* is connected to pinion *b* by means of a sleeve; pulley *e* is an idler and *f* actuates pinion *c* through a collar. A carriage traveling along the threaded shaft *g* shifts the belt from *f* over *e* to pulley *d* periodically by means of a lever system, consequently changing the direction of rotation of bevel gear *a*. This change takes place about every fifteen minutes. The gear that

is keyed to shaft located in center of alley meshes with the worm gear *h*. Another arrangement with a worm gear drive is given in Fig. 11.

The main shaft that moves the channels extends the entire length of the alley and is usually 3 or 4 in. in diameter. It is supported by trestles 6 ft. high and made of channel steel. Details of a support are given in Fig. 7. There is a support with a pillow block for each pair of buildings. Couplings are placed every 16 or 20 ft.

Over each support is a thirteen-tooth flanged pinion for engaging teeth in a rack or cog plate that is on the under side of an inverted tee steel beam connecting end trucks in opposite buildings. The rack is made of cast iron, containing forty-two teeth and is about 62 in. long. A stirrup of iron or roller is used to assure engagement of the rack and pinion. The entire table of channels and scrapers is moved by this rack and pinion, the channels having a straight line reciprocating motion of 55 to 60 in. which occupies a period of time of fifteen minutes. In a typical 60-bbl. plant there is approximately 200 tons of iron and steel in the condensing buildings, which does not include frame work or sheet iron covering that enter in the construction of the buildings.

The conveyors are drawn by a shaft belt connected to the main power shaft in the engine room. One 1-in. shaft lies on each side of the alley and transmits power to the conveyors in the condensate buildings by means of bevel gears. Another conveyor runs along each side of the alley that is chain driven by a sprocket wheel on the 1-in. shaft. These conveyors carry all of the black from the buildings to an elevator which is simply an endless chain having buckets attached. The elevator is enclosed in a 16-gage galvanized sheet iron box.

The grit, scale and hard particles in the carbon black are removed by the bolting machines that vary greatly

<sup>1</sup>See Technical Paper 232, p. 20, W. P. Dykema and Roy O. Neal, U. S. Bureau of Mines, 1919.



in design. The practice is also different at various factories. Some operators pass the carbon through two bolters, some through one, while others are not equipped with machines. At a few plants there is an apparatus fitted with coarse wire for removing bolts, pieces of iron and similar articles, which is called a "scalper." The bolting machine may be of the horizontal or vertical

type, although the latter design is more commonly employed.

Details of a machine that is largely used are given in Fig. 12. It is made of 20-gage galvanized iron. The size of the steel screen used varies from 45 to 60 mesh, which is held up by a heavy wire as reinforcement. The screen is attached to a cylinder that can be removed through

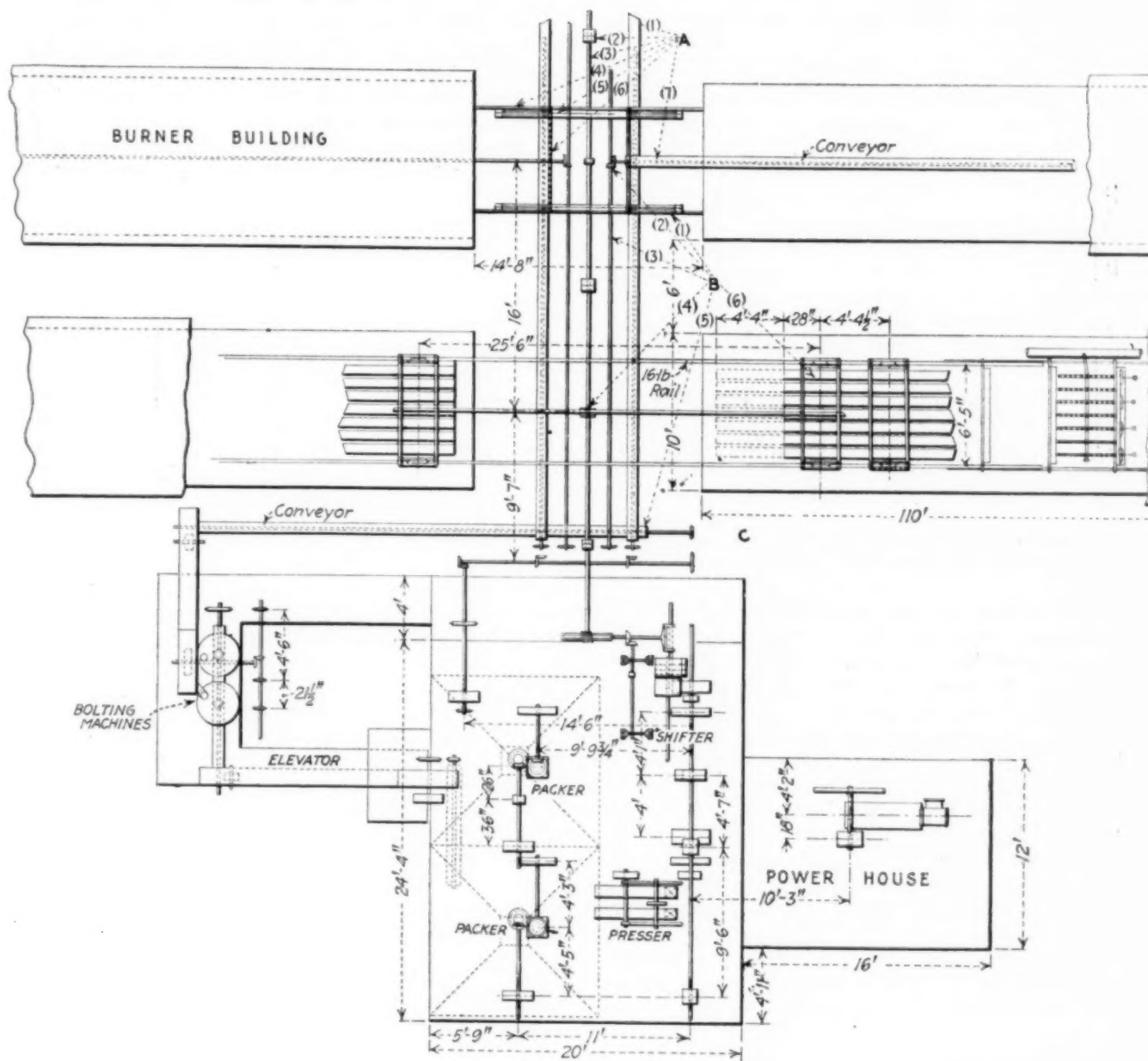


FIG. 9. PLAN OF TYPICAL PLANT

A1—8-in. spiral conveyor receives material from conveyor extending through entire length of each building.

A2—On main drive shaft couplings are placed, spaced 16 ft.

A3—3-in. main drive shaft, extending entire length of alley between buildings.

A4—16-in. rail of track on trestles in opposite buildings extends continuously across alley, connecting and bracing opposite trestles.

A5—A two bent steel trestle in alley between opposite buildings affords a brace for buildings and supports main drive shaft and conveyors.

A6— $\frac{1}{2}$  x 2 x 2-in. angle iron tying trestle bents at top and supporting 16-16 rail crossing alley and connecting opposite buildings.

B1—2 pieces  $\frac{1}{2}$  x 2 x 2-in. angle iron forming batter post for trawle.

B2—5½-in.-20-tooth cog on conveyor drive shaft engaging 10-in.-40-tooth cog on shaft of conveyor extending through building.

B3—Drive shaft (1-in. Stand. G. P.) for conveyors which extend entire length of each building.

34—Flanged pinion to engage teeth in G. I. cog plate on under-

side of inverted T-steel connecting end trucks in opposite buildings (6 in. diameter, 3½ in. face, 13 teeth.)

B5—Conveyor from conveyors in alley to elevator.

B6—Channel iron placed with flanges turned upward and spaced 10 in. o.c. Bolted to under side of trucks. Seven pieces of  $\frac{1}{2}$  x 2 $\frac{1}{2}$  x 18 in.

C—To each bent is fastened a sheet iron hopper held in position by being wired to angle irons between bents.

Bent posts are made of gas pipe spaced 6 ft. 6 in. wide and held in position at top by 1½ x 1½-in. angle iron.

Each hopper tapers toward its lower end and deposits its contents into a spiral conveyor. Between hoppers is arranged a system of gas pipes, which provides burning gas flames under each channel.

Bents are spaced 5 in. o.c. on top and 50½ in. on bottom and held in position on top by means of 1½ x 1½-in. angle irons.

Along center of each hopper is arranged seven scrapers, which bear on under side of channels to which trucks are bolted, pressure being obtained by means of weights on outer end of rods. Double gudgeon truck wheels, 1½ in. bearing x 10 in. diameter, made by Styles Mfg. Co.

the drop door. A shaft having a spider with six arms, each of which carry two fiber brushes, forces the carbon black through the screen. The product not passing through the screen is discarded periodically as waste material.

#### STORAGE BINS AND PACKERS

The storage bins are made of galvanized iron and vary in size. They are tapering-shaped hoppers located over the packers. Some operators use bins of sufficient

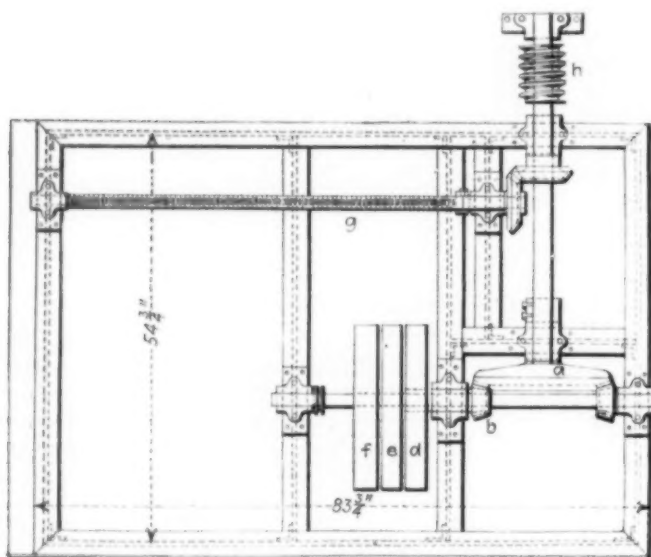


FIG. 10. REVERSING GEAR SHIFT

size to store two or three days' production, in order to eliminate any shut-down due to trouble in the packing room or to hold the carbon black made on Sunday, as in some plants the packers operate only six days per week.

The packers are very similar to those used at sugar refineries. An auger works inside of a tight sheet steel tube, pressing the carbon black into a paper sack. The auger is designed to stop the waste of the free-flowing stock running out between the blades of the auger when the packer is stopped for changing sacks. The stock, when passing through the auger, keeps the hinged gates folded parallel to and against the top auger blades. When the auger stops, the coil springs force the gates downward against the carbon lodged between the blades, not closing the passageway completely, but holding it back sufficiently to prevent leakage. The machine is gaged to pack a uniform amount in each sack, which is

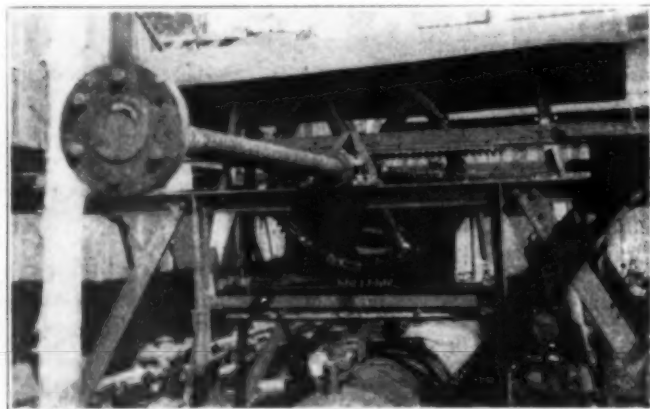


FIG. 11. DRIVING WORM GEAR CHANNEL PROCESS

usually 12½ lb., or a quarter of a barrel. In some cases, especially for export trade, the sacks contain 15 lb. The device starts by a simple movement of a lever which causes the bevel gears to mesh, and stops automatically when the sack has been filled with 12½ lb. of carbon black. The packer is connected to a storage bin by a spout.

A 60-bbl. plant usually is equipped with four packers that fill a sack in approximately fifteen minutes. The inner shaft rotates slowly in order to effect the proper separation of the carbon black from the air, in which it floats or holds mechanically. The problem of packing is to separate the black from the air as far as is commercially practicable.

The sacks are tied, and in most plants slightly compressed. The compressor consists of a steel plate box,

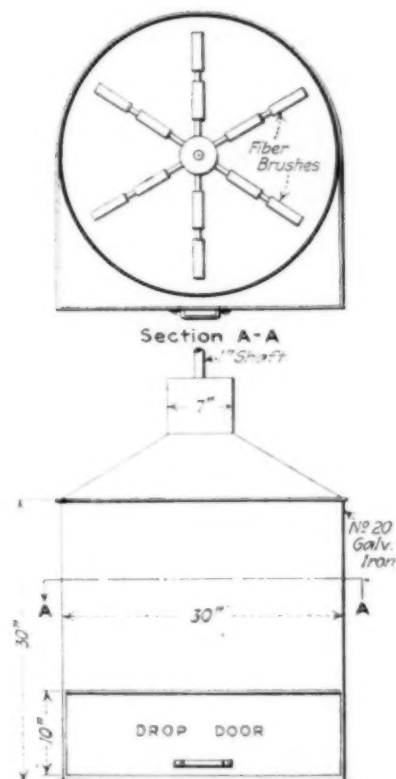


FIG. 12. DETAILS OF A BOLTING MACHINE

in which a plunger, actuated by a crank shaft or eccentric, travels. The sides of the sack are flattened to facilitate storing and transporting. After compressing, another paper sack is placed over the package.

The sacks of carbon black are removed from the packing building by trucks to the warehouse. If the black is to be sold to export trade, it is packed in wooden boxes 3 x 3 x 2 ft., holding from twelve to fifteen sacks each. The warehouses are located on the main transportation line, or on a narrow-gage railroad, that has electric or gasoline engine-driven trucks which convey the product to a transfer point. The warehouses differ greatly in size. At one plant that was visited by the writer, a stock of 35,000 sacks of black was stored, with spaces available for an equivalent quantity more. The warehouses may be open wooden frame buildings with corrugated sheet iron roofs, or completely inclosed sheet-iron buildings.

The disk, plate and cylinder processes will be described in a subsequent issue.



## Foundry Methods for Light Aluminum:Copper Alloys

A Statement of Melting and Alloying Practice in Vogue in America for the Production of No. 12 Alloy, and a Discussion of the Apparent Advantages and Disadvantages in the Use of Copper or Various Copper-Rich Hardeners

By ROBERT J. ANDERSON\*

**I**N MANUFACTURING light aluminum:copper alloys for sand castings and for die-casting purposes several distinct problems exist which are of interest to aluminum founders. These problems are those which are connected (1) with the method of alloying copper and aluminum so as to produce alloys containing from, say, 2.0 to 14.0 per cent copper; (2) with furnace temperatures; and (3) with melting practice. Casting losses, oxidation and dross losses, and melting costs may vary considerably, depending upon the mode of manufacture of these alloys. The present article deals with the commercial manufacture of light aluminum:copper alloys in the United States, but so-called aluminum bronzes are not considered. In addition, experiments made in studying methods of preparing No. 12 alloy are described.

### LIGHT ALUMINUM: COPPER ALLOYS

In aluminum founding the light aluminum:copper alloys are preferred for general casting purposes, and alloys of aluminum with other metals are not actually used to an important extent. The usual alloy employed in the United States for sand castings is one containing approximately 92.0 per cent aluminum and 8.0 per cent copper, and in fact this is virtually the present standard casting alloy. There are, however, several other distinct binary aluminum:copper alloys employed for commercial castings; these alloys contain from 2.0 to 14.0 per cent copper and remainder aluminum. An alloy containing 96.0 per cent aluminum and 4.0 per cent copper is used extensively in the United States for sand-cast cooking utensils and for some automotive castings; alloys containing 9.0 to 10.5 per cent copper and remainder aluminum are used for certain automotive castings, principally manifolds and pistons. A few alloys containing, say, 12.0 to 14.0 per cent are employed for particular purposes in England. In the United States the consensus of opinion among aluminum founders and automotive engineers is that the alloy containing about 92.0 per cent aluminum and 8.0 per cent copper (known in the trade as No. 12 alloy) is the best available for general casting purposes.

According to a recent survey by the Bureau of Mines, it is estimated that about 97 per cent of the so-called aluminum castings made today are poured from No. 12 alloy. The greater part of the remainder is cast from other aluminum:copper alloys, and the balance from other binary and complex alloys. There are a number of other aluminum alloys used for castings such as aluminum:magnesium, aluminum:zinc, aluminum:copper:zinc, aluminum:copper:tin, and aluminum:copper:manganese alloys; however, the total annual

output of castings made from these alloys is small with respect to the output of No. 12 alloy castings.

### COMMERCIAL No. 12 ALLOY

Strictly speaking, commercial No. 12 alloy is not a simple binary alloy in most foundries because of the usual presence of appreciable amounts of certain impurities, notably iron. Where the iron is high, and this element is frequently present in amount up to 2.0 per cent, the alloy should be properly regarded as a ternary aluminum:copper:iron alloy. This distinction may appear to be academic, but it really is not, because increasing amounts of iron markedly affect the properties of the alloy. As a matter of fact the iron content of most of the No. 12 alloy cast today ranges from 0.75 to 1.50 per cent, with an average of about 1 per cent.

No. 12 alloy is made up in foundries for casting purposes by a number of methods, and a variety of materials may be employed in the melting charges, and No. 12 casting ingot is marketed by primary and secondary ingot makers. Primary No. 12 ingot is made ordinarily by aluminum producers directly from virgin metals, while secondary No. 12 ingot is run down by smelters and refiners from aluminum-alloy borings and turnings, scrap castings, aluminum clippings, and other aluminum and aluminum-alloy scrap. In the foundry the methods employed for the manufacture of No. 12 alloy vary considerably, depending upon individual preferences, upon conditions and prices in the primary and secondary aluminum markets, and upon other factors. From the metallurgical standpoint, however, the principal consideration involved is the method of introducing the copper. This is especially important in foundry practice because the method employed for making the alloy affects dross losses, oxidation, shrinkage and casting losses, as well as costs.

### PRESENT FOUNDRY METHODS

At the present time there are two well-defined methods used for alloying copper with aluminum in the commercial manufacture of light aluminum:copper alloys for casting purposes in the foundry; conflicting opinions have been expressed as to which one of these methods is the more advantageous. The methods employed in commercial practice call for the use of (1) copper, and (2) a rich copper:aluminum alloy such as 33:67 or 50:50 alloy.

Some foundries prefer to make No. 12 alloy or other light aluminum:copper alloys by the addition of solid copper to liquid aluminum. This is quite a common practice in small foundries, but it is not used much in the large plants. Where copper as such is employed the usual practice is to melt the aluminum first, and then add the requisite amount of copper later. Thus, for a small heat of No. 12 alloy, say 100 lb., the

\*Published by permission of the Director, U. S. Bureau of Mines.  
\*Metallurgist, U. S. Bureau of Mines, Pittsburgh, Pa.  
\*Anderson, R. J., "Special and Commercial Light Aluminum Alloys," U. S. Bureau of Mines, War Minerals Investigations series, Bull. No. 14, April, 1919.

melter will first liquefy 92 lb. of aluminum in a crucible and then add 8 lb. of light sheet copper. The copper is alloyed by diffusion and partly by solution. In foundry practice copper is usually employed in the form of clean light-gage sheet, clippings and punchings, light sheet scrap, or scrap wire. Rarely, if ever, is the copper added in the form of ingot or cake copper, because large, massive pieces require too long a period of time for solution.

#### USE OF SOLID COPPER

Copper as such is used because it is supposed to alloy satisfactorily, and to save the cost of preparing the rich alloys, such as 33:67 and 50:50 copper:aluminum. There are some apparent advantages in the use of copper direct, but at the same time some obvious objections. While many conflicting opinions have been expressed in considering the use of copper rather than a rich alloy, the most apparent advantage in the former would appear to lie in the saving made by obviating the cost of manufacture of a rich alloy.

The presumed difficulty of dissolving solid copper in liquid aluminum has been offered as an objection, but there is no basis in fact for this, because copper, in the form of light-gage punchings and sheet, goes into solution in aluminum quite rapidly at 700 deg. C. (considerably below normal furnace temperatures in aluminum-melting practice). More massive pieces of copper dissolve more slowly at low temperatures but go into solution fairly rapidly at 900 deg. C., as has been shown by experiment.<sup>2</sup> Hence, if bulky and heavy copper is used, the melting charges must be heated to rather high temperatures, and this is decidedly inadvisable for aluminum alloys—where high furnace temperatures are permitted in melting the resultant castings are likely to be porous, unsound and leaky because of gas absorption and oxidation of the alloy. In case the copper is dirty or greasy it is advisable to boil it in sodium hydroxide, as is done by some foundries, but cleaning for the mere sake of securing a bright surface simply adds to the production costs. If the copper is covered with a considerable layer of copper oxide ( $\text{Cu}_2\text{O}$ ) or if the copper oxide content of the copper is high an appreciable thermit reaction will take place when the solid metal is added to liquid aluminum; badly oxidized copper should not be used, as it thus increases the dross losses.

#### ADVANTAGES AND DISADVANTAGES OF USING SOLID COPPER RATHER THAN A RICH COPPER ALLOY

A few foundries prefer to use copper rather than a rich alloy on the ground that the former minimizes errors in weighing, but this seems to be a dubious advantage, if any exists. Some foundries have had difficulty with porosity and excessive shrinkage in castings made by the use of copper direct, while others have experienced non-uniformity of product, where the castings run "hard" and "soft." Both porosity and shrinkage might be readily traced to causes other than the method of making the alloy, and since molding and melting practice influence these defects it is not possible to deal with this objection without more complete data. Heterogeneity of composition (hard and soft castings) can logically follow from the use of copper either because of failure to secure complete solution

of the copper or because of insufficient stirring and mixing, and much of the trouble experienced by foundries in the use of copper has doubtless come from inadequate mixing. In the case of poorly mixed No. 12 alloy made by adding copper to aluminum it is not unusual to find the first pour running 3 to 5 per cent copper and the last pour 9 to 11 per cent copper. It takes a longer time to dissolve copper in aluminum than it does to dissolve the rich alloys, principally because of the difference in the melting points; viz., aluminum, 658.7 deg. C.; copper, 1,083 deg. C.; 33:67 copper:aluminum alloy, 540 deg. C.; and 50:50 copper:aluminum alloy, 575 deg. C. Metals which form solutions in the liquid state and in whole or in part in the solid state are more easily alloyed the less the difference in melting points.

As to the possible saving in cost made by using copper instead of a rich alloy, this may be offset by the greater expense incurred in dissolving the copper, and it may be further offset by comparative figures on casting losses, and also dross losses.

#### USE OF 33:67 Cu:Al ALLOY

An alloy containing 33 per cent copper and 67 per cent aluminum is employed in some foundries, but it is less widely employed than either pure copper or 50:50 copper:aluminum for the manufacture of No. 12 alloy. The alloy in question has the minimum melting point of the binary system, and shows a typical eutectic structure; it melts at about 540 deg. C. (1,004 deg. F.). The 33:67 alloy does not segregate within itself as does 50:50 copper:aluminum, and this is an advantage pointed out by foundries who use the former for introducing copper into aluminum. As is well known, when a eutectic alloy freezes the crystallization of both components takes place simultaneously, and thus forms a very intimate mixture. Such an alloy cannot properly be considered as homogeneous, but the intimate mixture might approach homogeneity. The low melting point of the 33:67 alloy is also of advantage, for if placed in liquid aluminum it quickly alloys, since it is melted almost immediately. If charged solid together with solid aluminum it will melt first, but there will be some diffusion of the solid aluminum into the liquid alloy before the former melts. In foundry practice 33:67 copper:aluminum alloy, aluminum ingot and foundry scrap are charged in the proper proportions so as to produce No. 12 alloy, and the relative amounts of each material used in a charge may vary considerably.

The main disadvantage in making and using the 33:67 alloy lies in the fact that so much aluminum must be melted in preparing it, and larger quantities of the alloy must be remelted in manufacturing No. 12 alloy. The objection is also offered that it is not so easy to calculate the make-up of charges when using this rich alloy. This is not a serious objection, but the former disadvantage is. However, it has been shown to be a satisfactory rich alloy, from the metallurgical standpoint, for introducing copper into aluminum.

#### USE OF 50:50 Cu:Al ALLOY

The majority of the foundries in the United States favor the use of the 50:50 copper:aluminum alloy for introducing copper into aluminum. This alloy melts at 575 deg. C., but it is liable to be badly segregated unless thoroughly stirred during its preparation and then frozen rapidly by casting into chill molds. If segregated it may cause some non-uniformity in suc-

<sup>2</sup>R. J. Anderson, "Diffusion of Solid Copper in Liquid Aluminum," CHEM. & MET. ENG., vol. 23, No. 12, p. 575 (Sept. 22, 1920).



cessive heats of No. 12 alloy, but ordinarily no trouble should occur from this source. Due to the fact that the 50:50 alloy melts at a lower temperature than aluminum, it will readily alloy. The objections offered to both the rich alloys include the cost of making the alloys and the liability that weighing mistakes may be made in the melting room. In using 50:50 copper:aluminum the requisite amounts of the alloy and aluminum ingot plus No. 12 scrap are charged together.

It has been pointed out when discussing the use of copper directly in making up No. 12 alloy that the heats may run "hard" and "soft" because of failure to stir thoroughly. Even with the use of the rich alloys vigorous stirring is essential if castings of uniform composition are to be produced.

#### COMPARISON OF THE METHODS

In comparing the above methods from the practical standpoint the foundryman is interested in knowing (1) which method is the more economical, (2) which method is the more easily carried out in the foundry, and (3) which method gives the better castings. The tentative answers to these questions, as they appear to the writer, will be given after comparing the different methods in detail.

With regard to the use of copper, the main advantages claimed by foundries which employ that method are that there is less liability for error in weighing charges than when a rich alloy is used, and that the cost of preparing rich alloys is saved. The presumed former advantage appears to be untenable because, once the charges are calculated, weighing out definite amounts of metal is simple and can be done by very low-grade labor. The more apparent advantage, if it is one, should arise in reduced production cost brought about by the saving in cost of making a rich alloy. That advantage may be partially offset in some foundries because, in alloying copper with aluminum directly, the cycle will generally require a longer melting period. However, unless the proper relation between molding and melting is worked out the melting may be in advance of the molding, so that the charges might thereby be heated longer than actually necessary. The best practice would insure that the condition be reversed, and that the molding should always be in advance of the melting; in this way the heats would be poured as soon as ready.

There appears to be some difficulty at times in obtaining a supply of sheet copper suitable for the purpose in question, and less desirable forms of copper might have to be used with attendant disadvantages. The situation in regard to that matter may be largely dependent upon local conditions and periodic conditions in the copper scrap market. Scrap copper is available in the following forms: Heavy copper, consisting of copper not less than  $\frac{1}{8}$  in. thick (including heavy wire, clippings and punchings, and segments), No. 1 and No. 2 copper wire, and light copper (including fabricated copper and sheet). If foundries have difficulty in alloying solid copper with liquid aluminum the trouble lies in the use of too large pieces of copper, too little stirring, or too low temperatures. Of course, it is conceded that in ordinary melting practice the temperature should be kept low, say about 750 deg. C. or so; where the castings must be poured at higher temperatures, because of difficulty in running them, the furnace charges must be heated to 800 or 850 deg. C. However,

at both low and high temperatures solid copper alloys readily with aluminum if the pieces of copper are small and light.

One metallurgist in the light alloy industry has written to the author on the subject as follows: "Under usual working conditions—i.e., with the class of labor available, etc.—I do not believe it is possible to use pure copper. In the first place, I do not believe that a uniform product can be produced. Only the other day a case came to my attention where, a few years ago, a foundry went through a period of considerable trouble with its castings. For some reason it took this foundry a long time to discover why the castings were running hard and soft. The company making them was trying to alloy copper directly."

There is this to be said with regard to the use of copper: The tendency on the part of melters is to raise the heats to unduly high temperatures to hasten alloying, and further there is danger in not thoroughly stirring the melts. The writer's experience has been that copper may be used to advantage under certain definite conditions, and in fact it will be just as satisfactory in some cases as a rich alloy if proper attention is given to details. Metallurgically, it is generally recognized as poor practice to attempt to alloy metals of greatly different melting points directly in commercial work. In the case of aluminum:copper alloys the difference in melting points between copper and aluminum is 425 deg. C. In alloying the two metals by the addition of solid copper to liquid aluminum advantage is taken of solution and diffusion in the solid state, but normally the temperature may have to be raised somewhat above that necessary when using either of the rich alloys.

The use of a rich alloy, usually 50:50 copper:aluminum, is an old practice. In manufacturing light alloys in the foundry there are definite advantages in its use. There is no evidence to show that No. 12 alloy made by the use of a rich alloy is any better than when made with copper, but the device of employing a rich alloy is certainly a convenience. This alloy is very brittle, due to the presence of much  $\text{CuAl}$ , and this property enables the alloy to be broken readily and thus weighed with great accuracy when necessary. Furthermore, it is possible to hold the melting temperatures relatively low, and that is an important point. The 50:50 alloy is much more brittle than the 33:67 alloy, so from the standpoint of brittleness the former is to be preferred. The main objection offered in connection with the use of the 33:67 alloy is that more of it must be used than the other alloy in making No. 12; furthermore, it is not extremely brittle, and it is not so easily calculated.

#### CONCLUSION

It appears, taking everything into consideration, that light aluminum:copper casting alloys for casting purposes may be most conveniently made by using the 50:50 alloy. Under the conditions of fast practice which obtain in large foundries this alloy appears to be safer. There is less calculating to be done than in the case of 33:67 alloy; it melts at a lower temperature than aluminum; it is brittle and therefore can be weighed out with great accuracy; and, considering all factors, it is more fool-proof. The use of copper may be more economical in some cases. So far as quality of castings is concerned the various methods are doubtless equally good, provided thorough alloying is obtained.

## Proceedings of Rubber Division, A.C.S., Chicago Meeting, 1920

Committee Reports — Aging of Some Rubber Compounds — Microscopic Study of Vulcanized Rubber Containing Fillers — Organic Accelerators — Polysulphide Theory of Accelerator Action — Effect of Heat and Light on Vulcanized Rubber—Symposium on Rubber Analysis

THE convocations of the Rubber Division at the sixtieth meeting of the American Chemical Society in Chicago, Sept. 8 and 9, 1920, were held in Kent Hall, University of Chicago. About one hundred and fifty rubber men attended. In the absence of Dr. LEWIS the vice-chairman, G. D. KRATZ, presided.

### REPORTS

**Physical Testing:** Mr. SIMMONS reported considerable difficulty in obtaining the necessary co-operation from other bodies interested in rubber testing to permit the drawing up of standard methods. The Rubber Division of the American Society for Testing Materials was characterized by several as being quite dormant.

**Accelerators:** At the previous meeting a resolution aimed to prevent the sale of unknown and harmful accelerators under trade names was passed. The executive committee thought it better to not publish the information but to file it with the secretary, where it would be available for all members of the division. The report was accepted and Messrs. Bedford, Tuttle, Zimmerly and the secretary (Mr. Smith) were appointed a committee to put the plan into effect. All advertised accelerators will be listed and their exact composition determined. Information regarding them may be obtained from the secretary.

**Literature:** For the improvement of the analytical symposium, W. W. EVANS, of the B. F. Goodrich Co., distributed to the members of the division a volume of abstracts from the literature covering all phases of rubber analysis. He went as far back in the files as he could find anything of value attached to the work. The volume is an excellent addition to any rubber man's library. From this came the idea that it would be desirable to issue a volume of abstracts each year, so as to keep the members fully informed on all that has been done. It was pointed out that *Chemical Abstracts* has not the space necessary for longer abstracts. Frequently an important article in a foreign language must be so boiled down that it is practically denatured. Any chemist who might wish to use it will be forced to consult the original. This is not always easy to do. The members present were of the opinion that longer and more comprehensive abstracts could be prepared by themselves and given to one of the American rubber journals for publication. A committee consisting of Messrs. Evans, Hall and Bedford was appointed to handle the work during the coming year. Mr. Evans announced that since the vote was unanimous he understood that no one would decline any abstracting he might be asked to do. He also mentioned that at the next meeting a list of delinquent abstractors would be given out.

### THE AGING OF SOME RUBBER COMPOUNDS

This paper, by Mr. DEPEW, of the New Jersey Zinc Co. research laboratories, described accelerated age tests

carried on in an oven at 70 deg. C. for periods up to 16 days. Three compounds were chosen:

	A	B	C
First latex crepe	92.0	92.0	92.0
Sulphur	5.5	5.5	5.5
Hexamethylene-tetramine	1.5	1.4	1.4
Zinc oxide	84.0	98.0	22.0
Gas black			25.0
Lithopone		20.0	

Basing aging on decline in tensile strength with time, compound A was shown to be somewhat better than B and much better than C. B and C were worked out to have the same volume relations of filler to rubber. This would apparently indicate that from an aging standpoint it would be better to replace gas black, which is extensively employed with zinc oxide in pneumatic tire treads, by lithopone.

However, in the discussion following this paper it was pointed out by several that doubtless through inexperience the New Jersey Zinc Co. men had used approximately one part too much hexamethylene-tetramine and that the poor results obtained were probably due not to any fault of the black but to a formula not properly balanced with respect to sulphur and accelerator. Also in view of the fact that few rubber men are satisfied with the accelerated age tests as they now stand, it would appear that the conclusion above mentioned must be proved more conclusively.

### SOME MICROSECTIONS CUT FROM VULCANIZED RUBBER ARTICLES

The work described in this paper, also by Mr. DEPEW, was largely that of Henry Green and Roger Graver. The New Jersey Zinc Co. laboratories are perhaps further advanced in the application of metallographic methods to rubber than any others in America. In cutting sections of rubber an ordinary Spencer microtome is employed. The sample is frozen first by CO<sub>2</sub> and then by liquid air in a matrix of 90-10 water and glycerine. Liquid air is obtained from the manufacturer in Icy-Hot thermos bottles.

Slides showing the fineness of zinc oxide, aluminum flake, whiting and litharge were exhibited. The following sections were shown:

(a) White tread containing zinc oxide and magnesia as an accelerator. The zinc particles were all dispersed, but a large particle of magnesia was in evidence. The contrast was so great that Mr. Depew referred to it as a "rock."

(b) Red rubber sole. The particles of iron oxide and the fibers introduced for their stiffening action were visible. It was noticed that the particles were arranged in parallel lines following the direction of the grain of the stock.

(c) Gray tread. A white stock containing sufficient lamp black to "gray" it was exhibited. The lamp black was not well dispersed and agglomerates were in evidence. As before, the zinc oxide was well dispersed.

(d) A carbon (gas) black-zinc oxide stock. The



carbon black was found in agglomerates. The zinc oxide was well dispersed.

(e) Another section same as "d." Here both the zinc oxide and the carbon black were well dispersed.

(f) Side wall. Zinc oxide crystals and whiting were seen.

(g) Cushion. This stock contained 1 per cent of zinc oxide and a small amount of reclaim, which was evidenced by dark brown spots.

It was pointed out that by analysis one cannot differentiate blanc fixe from ground barytes. With the microscope this is very readily done. They are planning the use of polarized light for various fillers and staining methods for glue, etc.

In the discussion which followed it was pointed out by Mr. TUTTLE that the heating effect which leads to the disintegration and blowing out of solid tires is enormously increased by poor dispersion—i.e., by the presence of agglomerates.

#### THE ACTION OF CERTAIN ORGANIC ACCELERATORS IN VULCANIZATION OF RUBBER

The relative activities of molecularly equivalent amounts of aniline and diphenyl-thio-urea in the acceleration of vulcanization were compared in rubber-sulphur mixtures and in mixtures which contained zinc oxide in a paper by G. D. KRATZ, A. H. FLOWER and B. J. SHAPIRO.

In a rubber-sulphur mix the activity of aniline was found to be much greater than that of diphenyl-thio-urea. In mixtures which contained zinc oxide the reverse was true.

With aniline as the accelerator either in the presence or absence of zinc oxide the same maximum tensile strength was obtained, accompanied by a higher sulphur coefficient in the absence of zinc oxide than when this substance was present.

The mixtures which contained zinc oxide attained the same maximum tensile strengths at approximately the same sulphur coefficients, irrespective of whether aniline or diphenyl-thio-urea was employed as the accelerator.

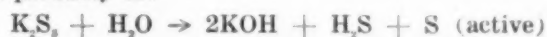
Kratz concludes that from his evidence there is approximately no general relation between the physical properties and sulphur coefficients of accelerated mixtures.

The activities of aniline, methylaniline, dimethylaniline, para- and meta-phenylenediamine, para-toluidine, para-benzidine, phenylhydrazine, and hydrazobenzene were compared in pure gum (8.1 per cent sulphur on the rubber). The accelerators were compounded in hundredth mole quantities. All samples were vulcanized ninety minutes at 148 deg. C. Para-toluidine in the above combination gave the best results (tensile 2,476 lb. per sq.in., 920 per cent elongation).

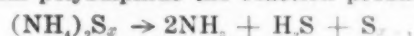
No definite relation was found to exist between the dissociation constants and the relative activity as accelerators except in the case of closely related series. This may be due to the fact that the substance itself is not the true accelerator, which is some product of its sulphur or other reaction. Thus hexamethylenetetramine reacts with sulphur, giving ammonia, hydrogen sulphide and other reaction products. In such cases dissociation constants are obviously poor indications of relative acceleration. KRATZ regards the  $\text{NH}_2$  grouping as of most importance in an accelerator, and finds it advantageous to think of it as a substituted ammonia. Adding a second  $\text{NH}_2$  group to the ring does not double the acceleration.

Substances such as aniline hydrochloride, etc., which decompose or react with other components of the mixture to form substances of acid character, do not accelerate unless a neutralizing base (such as zinc oxide) or salt is present.

In common with Van Horn, Kratz regards a preponderance of basicity as essential to acceleration. Thus Girard found that rubber could be vulcanized by heating it in a solution of potassium pentasulphide. The equation probably is:



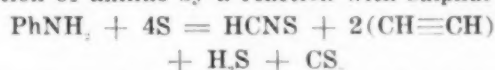
Kratz has found that ammonium polysulphide and even the hydrosulphide will also vulcanize. With ammonium polysulphide the reaction probably is:



With ammonium hydrosulphide (under pressure) Kratz obtained a coefficient of vulcanization of 4.4; with the polysulphide the value was 1.9.

#### A THEORY OF ACCELERATION BASED ON THE FORMATION OF POLYSULPHIDES DURING VULCANIZATION

Very few theories of the action of accelerators during vulcanization are to be found in the literature, declared C. W. BEDFORD and WINFIELD SCOTT. Ostromuiskensky considers the activation of sulphur to the formation of thio-ozonides of the type  $\text{RNH-S-S-S-HNR}$ , which pass sulphur to the rubber, then take up more sulphur, thus repeating the cycle. Dubosc considers it due to the formation of active sulphur by the reaction of sulphur dioxide and hydrogen sulphide. Dubosc seeks to explain the action of aniline by a reaction with sulphur



The authors obtained thio-aniline and hydrogen sulphide, but no acetylene,  $\text{CS}_2$  or thiocyanic acid.

Kratz, Flower and Coolidge stated that the activity of aniline was due to a sulphur addition product of aniline such as  $\text{PhNH}_2\text{S}$ , a product which admittedly is probably very unstable.

Taking ammonia as the simplest nitrogen-containing base, it reacts readily with  $\text{H}_2\text{S}$ , forming ammonium sulphide, which in the presence of sulphur is readily converted to the polysulphide  $(\text{NH}_4)_2\text{S}_n$  where  $n$  may have any value up to 9. Sulphur contained in the polysulphides is more reactive than rhombic or alpha sulphur. Polysulphides as sulphur carriers are quite common in the dye industry and are extensively employed in the manufacture of sulphur colors.

Thus they explain the acceleration of aniline as follows:



The curing value of para-phenylenediamine they attribute partly to its basicity, but mostly to the fact that at vulcanizing temperature it reacts with sulphur to produce ammonium sulphide along with other basic products.

Aldehyde ammonia liberates large quantities of ammonia during the cure, and at the same time by the action of heat forms strongly basic alkyl pyridine derivatives. Para-nitrosodimethylaniline, which Peachey classes as acidic, reacts with  $\text{H}_2\text{S}$  to give the strongly basic *p*-aminodimethylaniline.





stretching the test piece—i.e., it represents "input." The area under the former (the retraction curve) represents "output"—i.e., the work given up by the stock. The difference between the areas ("input" minus "output") represents "hysteresis loss." The hysteresis loss of rubber is very high.

Bouasse and Carriere in 1903 found that hysteresis diminished as the number of cycles increased, and finally reached an approximately fixed value. The difference between the first two cycles was found to be greater than that between any other two. Schwartz found in 1910 that the area of the loop became fixed much sooner in a high grade than in a low grade of rubber. He also found that when cycles were generated to a constant final load the increasing extension at the end of each cycle was proportional to the log of the number of the cycle in question. Also these workers found the shorter the extension the narrower was the hysteresis loop.

Another general rule laid down by Bouasse and confirmed by Schwartz is that the greater the speed of generation of the cycle the greater will be its area. You will at once appreciate the significance of this in regard to the internal heating of solid tires. Not only do excessive driving speeds multiply the number of loops per second and therefore the heat limited but they also actually increase the calories of heat generated per revolution of the wheel.

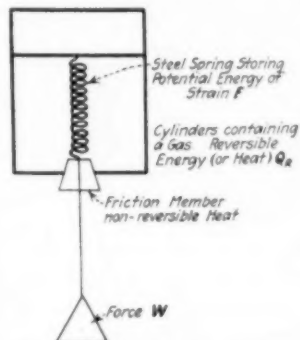
However, the area of the loop diminishes with increased temperature. It is quite fortunate that the reverse is not the case, since our solid tires and breaker strips in our pneumatic casings would go to pieces rapidly but for this compensating law. Incidentally, this temperature relation strongly suggests the resemblance in many respects of rubber to a viscous liquid. In fact, Shedd and Ingersoll use the term "viscosity loop" rather than hysteresis loop for this reason.

**Thermal Phenomena.** In 1805 Gough recorded that rubber increases in temperature on stretching. This was confirmed by Paige in 1847. Finally Joule also recorded the fact that while metals and other materials cooled on stretching, rubber became warmer. Lord Kelvin applied Le Chatelier's principle of equilibrium and predicted that stretched rubber must contract on heating. Joule confirmed this by experiment and this is now known as the Joule effect. The first stages of extension are accompanied by a slight cooling effect. The corresponding cooling which accompanies retraction of the stretched rubber is definitely less than the heating effect on the extension. This difference, representing the net increase in thermal content of the sample, is the exact equivalent of the hysteresis loop above referred to. This heat must be attributed to internal friction in the rubber.

Comparing the thermodynamical behavior of rubber with better understood systems will be of value. Gases when expanded or compressed isothermally develop pronounced thermal effects. In fact, the energy expended during compression is all turned into heat. Steel springs, on the other hand, are examples of systems which develop practically no thermal effects when deformed. All of the work done on the system appears as potential energy of strain.

Vulcanized rubber is intermediate between a gas and a steel spring. The accompanying figure contains the mechanical conception of rubber. A piston is moved downward by a force  $W$ . The rod passes through a friction member which furnishes lost or non-reversible

heat  $Q_F$ . The steel spring takes up the potential energy of strain  $E$ . The cylinder contains a gas which when compressed gives  $Q_R$ , the reversible heat. Rubber is the reverse of this picture. Thus when a piece is stretched we have energy stored up as potential energy of strain.



He uses a wide test piece and special non-slipping grips. He has found that the area under the third up-curve differs but little from those following. Therefore his test pieces are given two preliminary stretches and are then remeasured and placed in the machine.

The question as to whether he should run to constant load or constant elongation he has not entirely settled yet. Experiments have been made running the loops to from 100 to 500 per cent elongation. He found hysteresis loss (ft.-lb. per cu.in.) when plotted against cyclic elongation enormously increased when past 300 per cent elongation. Therefore he chose 200 per cent elongation and runs all his cycles to this point.

He found that the state of cure has an influence on the hysteresis loss. Cures varying from 50 per cent of the optimum to 275 per cent were made. In general, an undercure showed increased hysteresis, and the minimum loss was obtained with overcured samples. However, taking other considerations such as aging, etc., into account, a cure slightly less than the optimum is desirable.

However, the actual magnitude of hysteresis loss as it varies with state of cure is very low, and consequently ply separation cannot be attributed to it. On the other hand, hysteresis shows a marked linear increase with increase in volume ratio of the active fillers—i.e., those able to store up energy such as gas black and zinc oxide.

It should be pointed out that while carbon black and zinc oxide both give high hysteresis loss the heat conductivity of the former is much less than the latter.

**Tests on Tire Sections.** To obtain a measure of relative hysteresis losses in tires Wiegand cut 1-in. sections of various tires, clamped one end to a rafter and suspended from the other a long pendulum. By measuring the time necessary for the pendulum to come to a stop he had a measure of the damping effect or the hysteresis loss in the section.

Thus a 3½-in. plain tread stopped in 6 minutes.

Minus the first ply of fabric it stopped in 7½ minutes.

Minus the second ply of fabric it stopped in 8 minutes.

The tread and breaker alone stopped in 21 minutes.

It was found that the hysteresis loss of all the rubber in the section amounted to only that of one ply of fabric. The time of swing of the pendulum was found to fit the equation  $T_p = K_1 \times K_2^n$  where  $n$  = the number of plies and  $K_1$  and  $K_2$  are constants. The state of cure of the tire was found to be without effect. Mr. Wiegand mentioned that a 5-in. cord tire swings three times as long as the same size in fabric.

The remainder of the paper was practically the same

as that recently published in the *Canadian Chemical Journal* and the *Rubber Age*, except that he showed photomicrographs of the various fillers along with the stress strain curves at different volume relations.

Gas or carbon black he characterizes as the "aristocrat" of fillers, being much superior to zinc oxide and all others. He placed 20 volumes of filler to 100 of rubber as the point beyond which overloading takes place for both zinc oxide and gas black.

*Discussion.* It was admitted by all that this was a most remarkable contribution and illustrates the aid a physicist can be to the science of rubber technology.

C. O. NORTH illustrated a new type of stress strain curing curve where the loads at various percentages elongation were plotted against time of cure. This method is of particular value in studying accelerated stocks. He also illustrated a corrected stress strain curve where the loads for the various elongations were corrected to the actual cross-section area. It was pointed out that for all stocks examined to date up to 50 per cent elongation and in some cases up to 200 per cent elongation the cure is a straight line—i.e., Hook's law holds. By taking a tangent to the corrected curve at zero the cotangent of the angle of inclination is a measure of the direction or slope of the curve and may be called the true modulus. It is possible that this value may replace the other physical tests in describing the physical properties of a stock.

#### CONTRIBUTION FROM THE U. S. RUBBER CO. LABORATORIES

The paper by J. F. SCHUFTER on methods for determining free sulphur and antimony tri- and penta-sulphides in golden antimony was withdrawn, and informally substituted by "The Organization of an Information Service in Connection With Industrial Research Organizations" by R. P. ROSE and J. H. REEL.

They stated that in a large corporation 2 per cent of the total turnover may profitably be spent for development, and of this about 2 per cent for information service. A description of the excellent library system of the U. S. company was given.

#### THE ACTION OF HEAT AND LIGHT ON VULCANIZED RUBBER

JOHN B. TUTTLE presented a paper on "The Action of Heat and Light on Vulcanized Rubber." The action of heat and light on vulcanized rubber is frequently spoken of as being identical, and oxidation is said to be the cause of the deterioration. From published and unpublished tests it is shown that the action of heat is one of change in the rate of the chemical reaction between rubber and sulphur and goes on throughout the entire mass, whereas the action of light is one of oxidation, taking place on the surface. Heat produces no change in the solubility of the rubber substance in solvents such as acetone and alcohol, whereas light breaks up the rubber molecule, forming decomposition products which are readily soluble in acetone.

*Peachey Process of Vulcanization.* Samples prepared by Mr. Dales of the B. F. Goodrich Co. and by Mr. Kratz of the Falls Rubber Co. were exhibited. Very nice thin sheets were secured by passing H<sub>2</sub>S and SO<sub>2</sub> into dilute xylol solutions of rubber, combining them quickly and pouring on a glass plate. All attempts to vulcanize sheets of rubber by hanging first in one gas and then in the other resulted in surface cure only.

Contrary to Peachey's claim, sheets prepared by pour-

ing treated cement on a plate do contain free sulphur which is about as much as is combined.

It was the consensus that the Peachey process is at present of theoretical interest only. Those who have investigated it closely are not nearly as enthused with the idea as some foreign papers would have us believe the English are.

#### SYMPOSIUM, THE ANALYSIS OF RUBBER

This symposium was led by W. W. EVANS.

*The Tetrabromide Method:* H. L. FISHER. The various methods were discussed. It was pointed out that in the Lewis method about five times as much potassium iodide should be used as called for. Mr. Fisher was unable to obtain checks with any tetrabromide method and was particularly unfortunate with the Lewis method.

*Nitrosite Method:* A. H. SMITH. To summarize Mr. Smith's remarks, he finds the nitrosite method more accurate than the tetrabromide, but it is not sufficiently satisfactory for routine.

*Alcohol Soda Extract:* H. E. SIMMONS. The fineness of the sample is of great importance. The results obtained are of qualitative interest only. This statement also applies to the chloroform extract.

*Free and Total Sulphur:* J. B. TUTTLE. The sulphur in stocks may be classified as

Sulphur added—free or combined.

Sulphur in reclaim.

Sulphur in organic fillers—oil substitutes, M R.

Sulphur in inorganic fillers—sulphides, PbS, ZnS, Sb<sub>2</sub>S<sub>3</sub>, Sb<sub>2</sub>S<sub>5</sub>, etc.; sulphates, BaSO<sub>4</sub>, CaSO<sub>4</sub>, PbSO<sub>4</sub>; sulphites (in lead sulphate).

Sulphur in accelerators (thiocarbanilide, etc.).

Influencing the determination—PbCO<sub>3</sub>, BaCO<sub>3</sub>.

Decomposition of the rubber—(a) Solution (Carius); (b) fusion.

The objection to nitric acid is that the fumes carry off some of the free sulphur, thus giving low results when the sulphur is high, as in a cushion stock. Tuttle recommends a combination of fusion and solution methods. Fusion with an alkali is necessary to decompose such materials as BaSO<sub>4</sub>.

Do not evaporate down the solution from fusion. Keep it at 400 c.c. and the SiO<sub>2</sub> will not come out. Also do not blast the BaSO<sub>4</sub> precipitate. A Meker burner is satisfactory.

In determining free sulphur, bromine water as per Bureau of Standards method is giving good results.

The Parr calorimeter using Na<sub>2</sub>O and the oxygen bomb for total sulphur were discussed. Satisfactory results in some instances were recorded.

*Determination of Fillers:* H. B. UNDERWOOD. Mr. Underwood found no solution method satisfactory. He prefers to use the ash method with suitable corrections.

During the discussion it was mentioned that the xylol-naphthalene method was perhaps the most satisfactory.

#### ELECTION OF OFFICERS

The following men were elected for the coming year: Chairman, W. W. Evans, B. F. Goodrich Co.; vice-chairman, C. W. Sanderson, Fisk Rubber Co.; secretary, A. H. Smith, Goodyear Tire & Rubber Co.; executive committee, G. D. Kratz, Falls Rubber Co.; J. B. Tuttle, consulting engineer, New York; C. W. Bedford, Goodyear Tire & Rubber Co.; H. E. Simmons, Akron University; J. R. MacGregor, Eagle Picher Lead Co.



## Chemical Industries Likely to Lose Natural Gas Supply

By R. S. MCBRIDE\*

**T**HERE is a great prospect that chemical industries, among others, will have their natural gas supply cut off in certain important districts during the coming winter and it appears unlikely that these supplies will ever again be restored for these industrial uses. The indications of such drastic action on the part of the several state public service commissions having jurisdiction point to these conclusions definitely.

In the tri-state district of West Virginia, Pennsylvania and Ohio, where 70 per cent of the natural gas of the United States is produced and used, the state commissions have been co-operating, together with the commissions of Maryland and New York State, in the consideration of regulations regarding the conservation of gas. It is expected that these commissions will concur in and adopt the several resolutions which were proposed by the national committee on natural gas conservation which worked under the auspices of the Department of the Interior. A report of this committee dated June 11 recommends careful attention to the question of how industrial gas supplies may be curtailed in order to give adequate supply for the domestic users. The importance of this movement to chemical industries is obvious, for among those activities which will receive first attention are the ceramic manufactories, brick kilns, glass factories, carbon-black plants and others which are using natural gas in large quantities.

These five public service commissions have met several times already in conference. They met again on Sept. 10 to decide important policies, and the action above indicated is likely to result from their deliberations. Certainly the Pennsylvania commission gives clear intimation that this will be its findings unless new facts are developed.

\*Engineering Representative, McGraw-Hill Co., Inc., Washington, D. C.

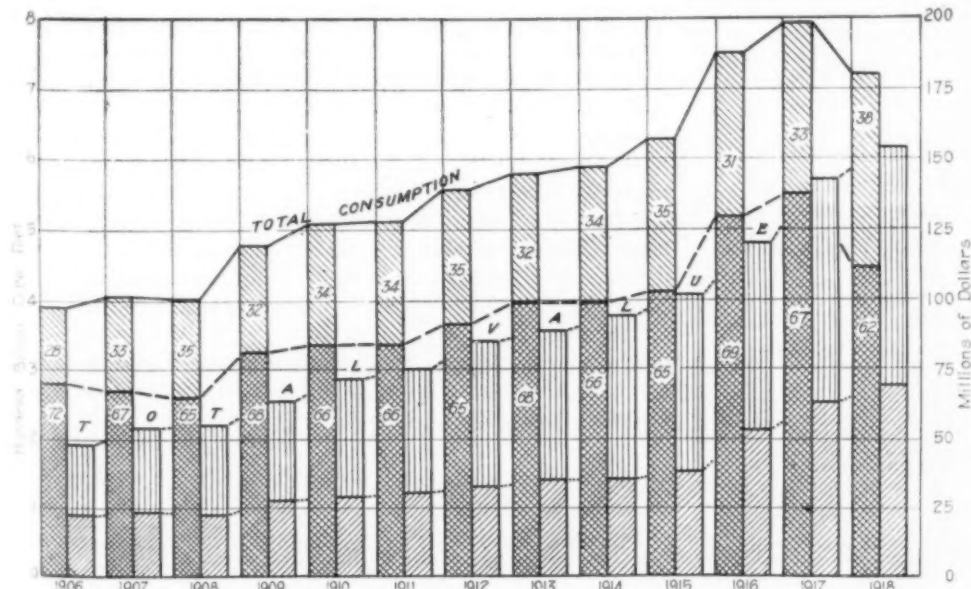


FIG. 1.

Diagram showing the quantity and value of natural gas consumed in the U. S. from 1906 to 1918. The first bar shows at the bottom the per cent of industrial gas and at the top the per cent of domestic fuel consumed. The second bar shows in the same order the values.

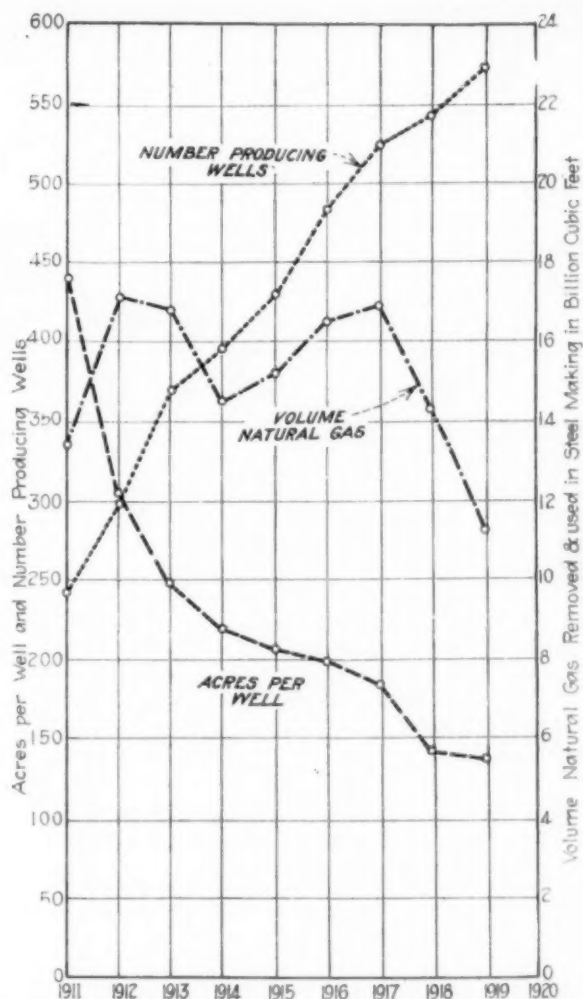


FIG. 2. DECLINE IN WEST VIRGINIA NATURAL GAS USED IN STEEL MAKING BY THE U. S. STEEL CORP.

Based on statistics filed with the West Virginia State Board of Public Works. The number of acres per well has declined from 438 in 1911 to 135 in 1919. The volume of gas removed has declined from 13.3 billion cu. ft. in 1911 to 11.2 billion cu. ft. in 1919. During the same time the number of producing wells has increased from 239 to 571.

The proportion of gas used for industrial and domestic consumers is shown in Fig. 1. (Prepared by E. G. Sievers, U. S. Geological Survey.) It should be

noted that the total quantity of gas available for sale is now decreasing; and this decrease must be borne almost altogether by the industries, since as a matter of general policy it seems widely recognized that the domestic use is of superior importance in a community as a whole, and must be given priority. One of the indications that this effect is already noted is shown in Fig. 2, which was presented by Samuel S. Wyer in his report dated July 7 on the gas situation of the Philadelphia Co. of Pittsburgh. This chart shows the very striking decline in the quantity of natural gas used by the United States Steel Corporation for steel making.

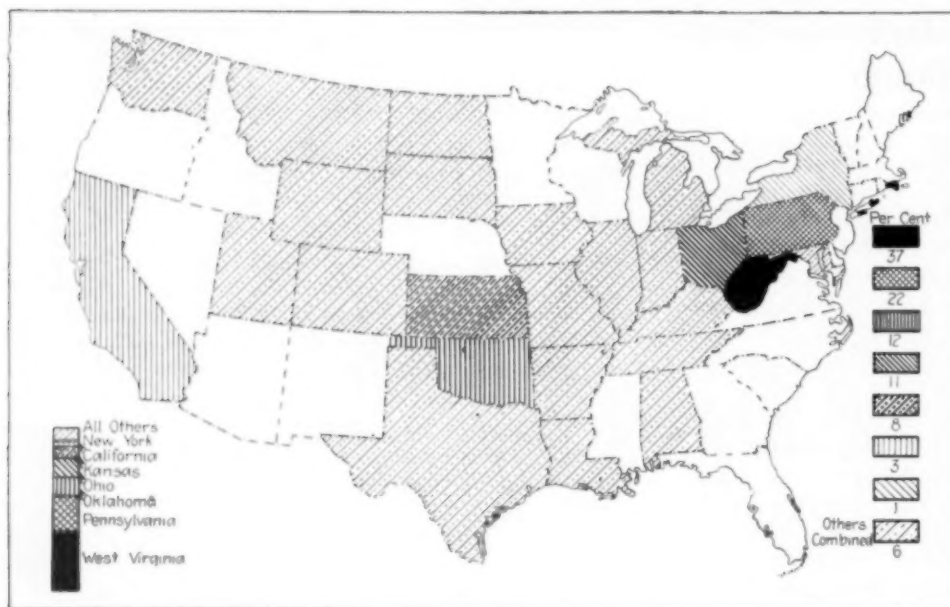


FIG. 3.

Map of United States, showing by states the percentage of natural gas produced from 1906 to 1918.

Fig. 3 (prepared by E. G. Sievers, of the U. S. Geological Survey) shows the dominating importance of the district in question, for, as indicated above, the three states, Pennsylvania, Ohio and West Virginia, jointly represent 70 per cent of the natural gas production of the United States. Moreover, it is to be expected that any conclusions reached with respect to this particular

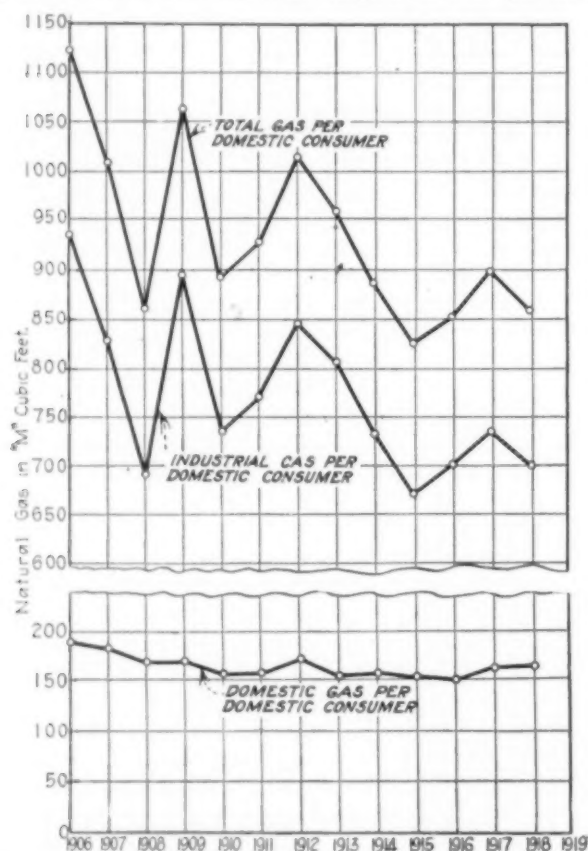


FIG. 4. DECLINE IN NATURAL GAS CONSUMED IN WEST VIRGINIA

Based on statistics compiled by the United States Geological Survey. The domestic gas per domestic consumer has declined from 185 "M" per annum in 1906 to 165 "M" in 1918, or a decline of 12 per cent. During the same period the industrial gas per domestic consumer has declined from 932 "M" per annum to 689 "M" per annum, or a decline of 26 per cent, and the total gas per domestic consumer has declined from 1,120 "M" in 1906 to 854 "M" in 1918, or a decline of 23 per cent.

territory will also be adopted by the southwestern gas districts of Oklahoma, Kansas and Missouri, where the next largest proportion of gas production, 20 per cent of the total in the United States, is found.

That some curtailment of the industrial supply is to be expected seems certain. Naturally, use of gas under steam boilers will be one of the first uses attacked. This, however, will not be sufficient to accomplish the necessary improvement in domestic supply, and, as above indicated, the ceramic, glass making, carbon-black and related industries will doubtless be next in order for attention.

However, these industries are in a number of cases confronted with the necessity for use of a gaseous sulphur-free fuel, and where these particular uses can be demonstrated conclusively it is likely that the supplies will not be cut off until much more serious shortage is met. For example, certain of the glass-making processes, particularly flattening and annealing of plate glass, are accomplished with great difficulty when using any other fuel. A fuel containing sulphur is particularly objectionable because of the spotting effect on the plate glass. It seems important, therefore, that industries concerned in this problem should carefully analyze their needs and be prepared to present to the state commissions in due time their claims for special attention where these particular demands justify continuance of supply when other parts of the industries cannot be so favored.

#### France's Foreign Trade for First Seven Months of Year

French foreign trade continues to disclose the desired recuperation in the volume of exports, as compared with the imports, though the adverse balance remains formidable—more than 9 billion francs for the first seven months of the year. During this period, compared with the same period of 1919, there was an improvement of more than 7 billions in the exportations, the importations increasing nearly 3 billions at the same time. The gradual and sure increase in the amount of manufactured goods exported is an encouraging feature. This item shows an improvement of 4,603,984,000 francs over 1919.

The official figures in francs of imports and exports for the first seven months of 1920 and 1919 are as follows:

	Seven Months 1920	Seven Months 1919
Imports:		
Articles of food.....	5,395,180,000	5,706,445,000
Raw materials .....	10,153,394,000	7,369,082,000
Manufactured articles .....	6,212,168,000	5,946,713,000
Totals .....	21,760,742,000	19,022,240,000
Exports:		
Articles of food.....	1,088,721,000	528,315,000
Raw materials .....	2,775,208,000	763,235,000
Manufactured articles .....	7,594,169,000	2,990,185,000
Postal parcels .....	548,532,000	492,667,000
Totals .....	12,006,630,000	4,776,402,000



## Segregation in Bars for Steel Tubing

BY HAROLD D. NEWELL

FROM a large number of analyses collected and tabulated it is shown to be by no means unusual, in bad cases of segregation, to find a difference of 50 per cent or more in the percentage of the impurities (sulphur, phosphorus, silicon, manganese, etc.) in the same steel ingot or bar designed for boiler tubing. Such examples of segregation are ordinarily associated with high analysis of original impurities and high temperature of the casting. An example of such an analysis is:

	Sulphur	Phosphorus	Manganese	Carbon
Top of ingot.....	0.085	0.033	0.51	0.24
Bottom of ingot.....	0.032	0.019	0.47	0.15

This undue segregation has been prevented somewhat by allowing the metal to cool to the desired

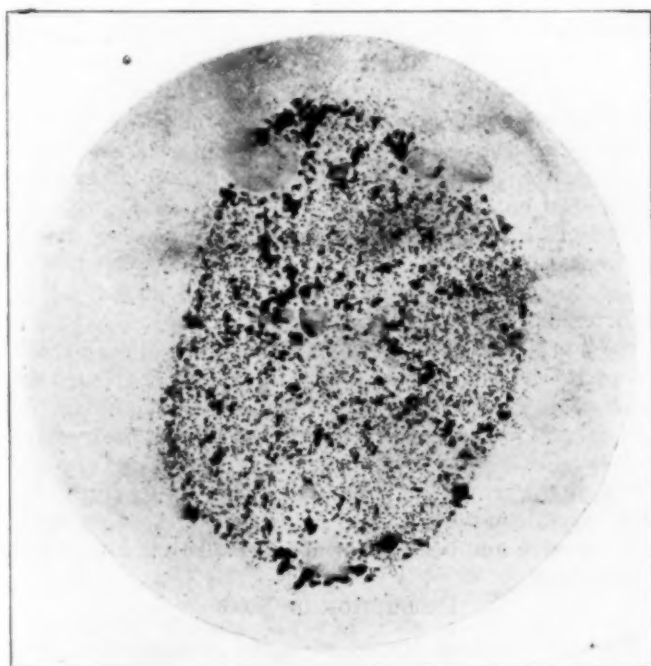


FIG. 1. SULPHUR PRINT SHOWING EXCESSIVE SEGREGATION OF FeS AND MnS

pouring temperature in the ladle, forming a skull of bad steel and slag on top of the heat, and pouring from under this skull. Steel makers, however, object to this practice, as it is expensive, the skull having to be put aside, broken up and remelted as scrap.

Provided care be taken in manufacture and the pouring be kept well under control, although there will always be some segregation, it should not be a serious matter in a good quality steel. It always occurs in rail steels to a greater extent than is desirable. It is advisable to keep the percentage of impurities in the ladle analysis as low as possible, because the proportion in which the segregating body is present will largely affect the result.

Casting of steel in large quantities undoubtedly favors unequal segregation or distribution; therefore, there will ordinarily be less segregation in a small ingot, especially if it sets and cools much faster than a large one. The rapid cooling on the outside of the ingot prevents segregation there, but the center, remaining fluid for a considerable time, allows the less soluble impurities to travel toward the center. Insoluble impurities, being specifically lighter than the steel, tend at

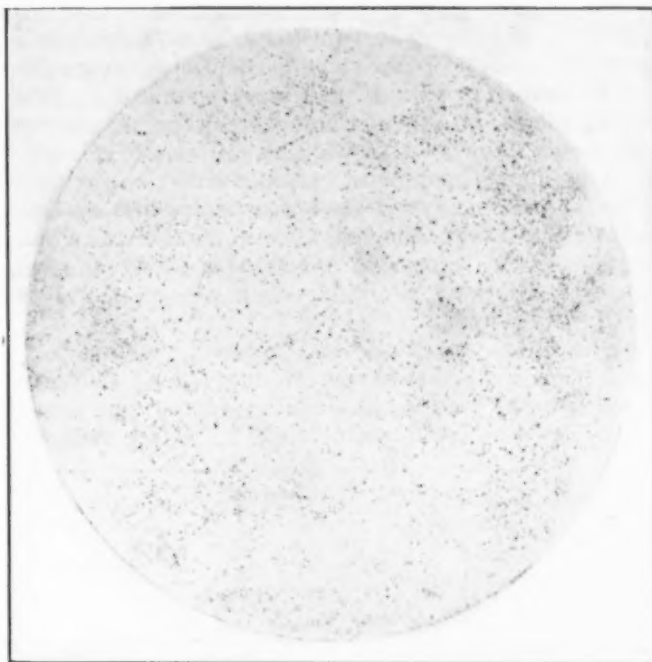


FIG. 2. SHEARED BAR SHOWING NO SEGREGATION

the same time to rise to the top of the ingot so that in the bottom center there will be less segregation than in the top center. Heavy cropping evidently is necessary to produce quality steel.

The author has been conducting a number of examinations for segregation in acid and basic steel ingots for boiler-tube steel with and without the additions of aluminum in the ladle. It has been concluded as a result that, in ingots to which no aluminum has been added, excessive segregation usually occurs down the central part of the ingot anywhere from 6 in. from the top to half-way down the entire ingot, sulphur tending to segregate the most, then phosphorus, carbon, and finally manganese. The effect of the addition of aluminum in the ladles as an oxidizing agent is to tend to reduce immediately the amount and depth of segregation.

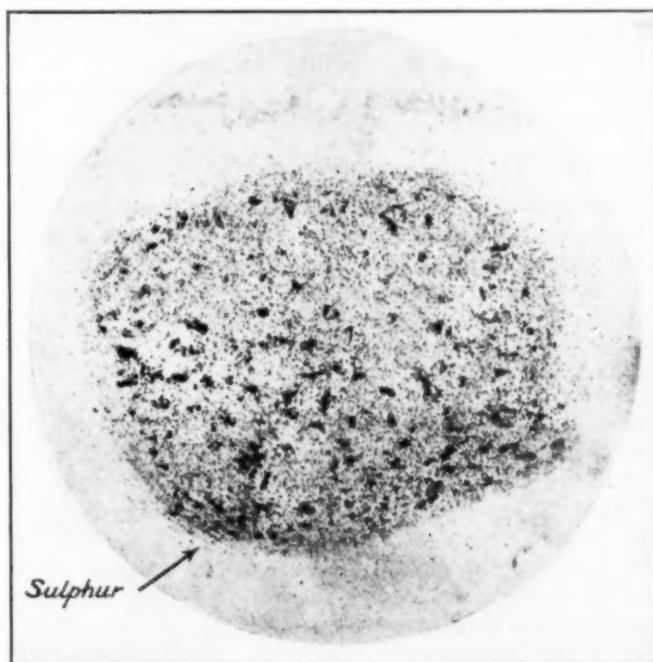


FIG. 3. SULPHUR SEGREGATION IN 3-IN. BAR FROM A BOTTOM-POURED BASIC OPEN-HEARTH INGOT

As is well known, steel tapped from the open hearth is usually more or less oxidized and contains a greater or less amount of iron oxide, which diminishes both its fluidity and strength. As this oxidized metal cools the oxide is partly reduced by carbon with the evolution of carbon monoxide gas, causing more or less violent ebullition and producing steel containing the well-known blowholes. Addition of small amounts of aluminum to such metal greatly facilitates the flow of metal from the ladle and also stops the violent evolution of gases, allowing the production of sound ingots without excessive blowholes. Two to five ounces of metallic aluminum per ton of metal is usually sufficient.

By suitable additions of aluminum blowholes, though always present, may be so reduced that finished material may be relied upon for our purposes. In most cases the blowholes weld up or are reduced

cracks develop which may even extend through the wall of the pierced billet.

Slag inclusions and dirty steel are also the cause of many rejections, as they produce tears and seams. Low-sulphur, bottom-poured basic open-hearth is always preferable for the manufacture of seamless boiler tubing. An example of what may be had is given in Fig. 2, which may be compared with Fig. 1.

Sulphur printing, using ordinary photographic paper, is a good way to keep tab on the sulphur segregation. Such prints showing excessive segregation of manganese and ferrous sulphide taken from rolled 3-in. rounds are given in Figs. 3 and 4. Ladle analyses for both cases conform with the above chemical specifications.

Pittsburgh Seamless Tube Co.,  
Beaver Falls, Pa.

### Condition of the Belgian Soap Industry

Soft soap is manufactured in practically every important Belgian center and while the factories are usually small there are several larger establishments which have entered foreign markets. Hard household soaps are produced mainly at Brussels, Verviers, Antwerp and Mons and are supplied in cakes, in blocks of all weights, in double bricks, and in yellow, brown, or marble color. Most of this production is used by home demand. Particularly at Verviers some soap manufacturers specialize in pure neutral soap which is used in the linen industry for glossing yarns and fulling fabrics. Toilet soaps are manufactured chiefly at Brussels, Liège, Verviers, Waterloo, Mons, Wavre and Tirlemont. Although importations are still large, the native article shows a tendency to replace the imported toilet soap. Soap powder, for household and industrial use, is a fairly recent innovation in Belgian factories and is almost exclusively made at Brussels, Verviers, Mons and Peruwelz. Medicinal soaps and specialties, such as transparent glycerine, tar, borax, floating bath, sand, pumice and beef-gall soaps, are also manufactured in Belgium.

### PRODUCTION OF SOAP

The following statistics give the comparative soap production in Belgium before and since the war:

Kind	1913	1919	Jan.-Mar. 1920
	Kilos.	Kilos.	Kilos.
Soft soap	17,000,000	3,903,000	2,092,000
Hard soap	6,700,000	5,561,000	2,680,000
Toilet soap	1,750,000	667,500	300,500
Soap powder	2,700,000	2,063,000	1,174,050

Many damaged soap factories were unable to begin work before March, 1919, and, aside from the shortage of raw materials, they met with active competition from American, French and British importers. During 1920 the demand has been most active for hard and powdered soaps, the producers of which were in a fair way to double their 1913 output until general market conditions cut off the demand.

### Steps to Raise the Price of Rubber

A recent report from London states that, to raise the price of raw rubber, drastic steps are contemplated by the Rubber Growers' Association, which represents about one-third of the owners of 3,000,000 acres of rubber plantations. The association suggests to members that they so reduce tappings of rubber trees as to effect a reduction of 25 per cent in the output.

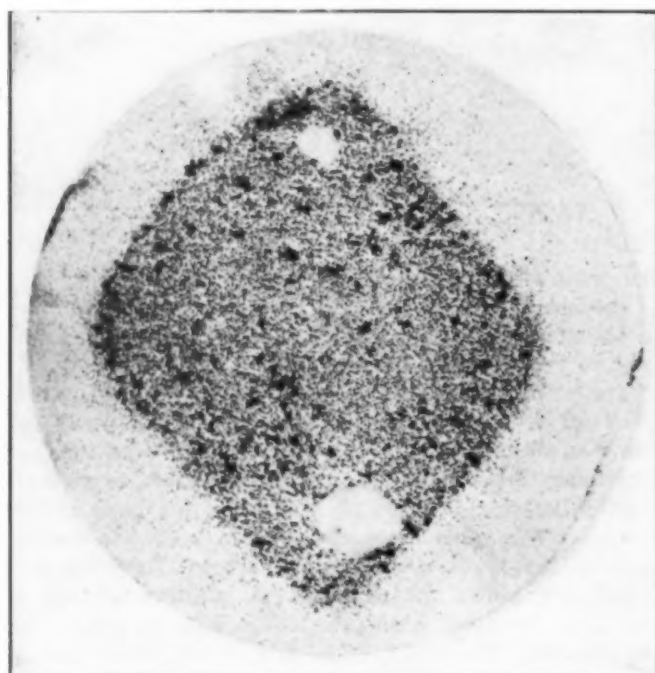


FIG. 4. SEGREGATION IN 3-IN. ROUND; ROLLED FROM A TOP-POURED SQUARE INGOT

to a minute size in the process of rolling. If this were not the case in carefully made steel, the production of sound tubes of thin gage would be impossible.

### SULPHUR SEGREGATION IN STEEL FOR BOILER TUBING

Segregation of sulphur is the cause of considerable trouble in the manufacture of seamless boiler tubing. The usual chemical specifications are:

	Per Cent		Per Cent
C	0.10 to 0.15	S	under 0.035
Mn	0.35 to 0.55	P	under 0.030

A heat containing over 0.035 per cent sulphur usually causes trouble at the piercing mill because of the tendency toward red-shortness in hot-working.

The segregated ferrous and manganese sulphides are thought to become semi-fluid at the working temperature of the furnace, thus lessening the cohesion between the grains of the metal. Because of the unequal strain set up in the solid nearly sulphur-free shell (Fig. 1) and the semi-fluid mass comprising the hot axis of the bar under the piercing operation, inside seams and



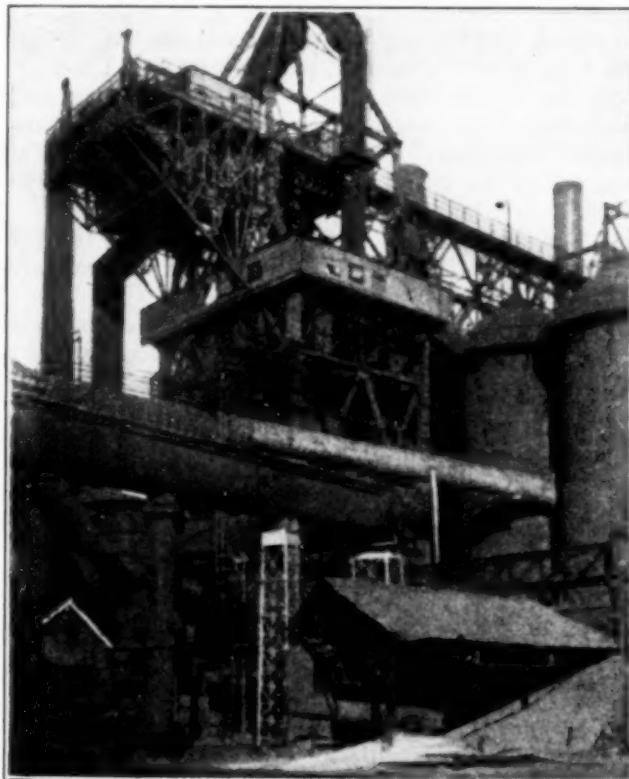
## Metallurgical Industry in Belgium

**T**HE Belgian metallurgical industry before, during and after the war is outlined by Emile Trassenster in the May 15, 1920, issue of *Revue Universelle des Mines*, pp. 271-320. The following is a succinct abstract:

The iron and coke industry during 1913 employed 39,500 workmen, and the coal industry 145,600 miners. There were forty-one coke plants with 2,898 coke ovens, producing 3,523,000 tons of coke, requiring 4,601,750 tons of coal, of which 39 per cent was imported. The

other country in the world reached such a high percentage of export; the United States, France, Germany and Great Britain exporting for the same year respectively 5, 13, 30 and 44 per cent.

The iron and steel industry, relying as it did on exporting more than four-fifths of the entire production, had to put up a hard struggle against competition, especially when it is considered that the competitors (Germany, France, United States) had their own iron ores, whereas Belgium had to import, as stated above, more than 99.5 per cent of the ore it needed. This was



AT LEFT A BLAST FURNACE IN 1917, AT RIGHT THE SAME BLAST FURNACE NOV. 20, 1918

consumption of fuel has increased in ten years from 20,228,000 tons in 1904 to 26,046,000 tons in 1913, whereas the production has remained practically stationary (22,761,000 tons in 1904 and 22,842,000 tons in 1913). During 1913, 8,856,153 tons of coal and 1,128,000 tons of coke were imported, as against 4,981,480 tons of coal and 1,002,000 tons of coke exported.

The fifty-four blast furnaces in operation produced 2,484,690 tons of pig iron, requiring 2,662,680 tons of coke, of which 24 per cent was imported, and 6,860,130 tons of iron ore, of which 84,900 tons—i.e., less than half of 1 per cent—was mined in Belgium, the remainder being imported mainly from France and Germany.

The 110 steel furnaces produced 2,466,630 tons of steel, of which 1,409,460 tons was finished steel; 110 puddling furnaces and 317 reheating furnaces produced 304,350 tons of finished iron and 448,400 tons of finished steel. There were in operation eighty hammers and 216 rolling mills for the production of the total of 2,162,210 tons of finished products, of which 1,161,425 tons was exported.

The total Belgian export of iron and steel during 1913 amounted to 1,762,170 tons, of which 213,203 tons was manufactured products. This represents an export of 81 per cent of the total produced. No

made possible by the efficient methods used at the plants and by the special quality of the products manufactured.

### PRE-WAR PRODUCTION OF ZINC AND OTHER METALS

The Belgian zinc industry dates from the time Dony discovered the commercial production of zinc. His small shop in Liège, installed in 1808, was the cradle of the great zinc industry. In 1809 the zinc sold for 3.60 fr. per kg. (about 35c. per lb.). In 1810 Dony enlarged his shop and installed a plant of eight reverberatory furnaces with forty retorts, producing 200 kg. zinc per twenty-four hours. The price was then 2.60 fr. per kg. (about 25c. per lb.). The industry grew gradually until in 1913 there were 510 furnaces with 43,444 retorts and thirty-seven mills requiring 480,645 tons of ore, of which only 355 tons was mined in Belgium. The total production of zinc reached 204,225 tons, of which 87 per cent was exported.

In the zinc industry, as in the iron and steel industry, Belgium had to work hard to maintain its rank of a zinc-producing country (204,225 tons out of the total world production of 982,000 tons) with only 355 tons of zinc ores mined in the country and the other needed 480,290 tons imported from practically all the zinc-producing countries in the world.

Lead and silver are practically the only other metals produced in Belgium. In 1913 28,865 tons of lead ore, practically all imported, was treated for the production of 13,590 tons of lead; 132,220 tons of lead or silver byproducts and 48,890 tons of lead scrap were imported, from which 254,000 kg. of silver was recovered.

#### SITUATION OF THE BELGIAN INDUSTRY DURING THE WAR

The Belgian metallurgical industry during the war suffered from the systematic devastation of the plants by the Germans, from lack of raw materials and from the cutting off of the foreign markets on which practically all the Belgian industry has to rely. A series of sixteen photos shows clearly the extent of the devastation.

The two views on page 747 show as a typical example what took place as late as 1918. Thus on the left is shown a blast-furnace installation as it was in 1917 and on the right the same furnace installation as it was Nov. 20, 1918, after all the useful parts, including the Cowpers stoves and cranes, were shipped to Germany.

Some idea of the depressing status of the Belgian metallurgical industries during the war might be obtained by analyzing the following table, which summarizes the metallurgical production of Belgium from 1913 to 1918:

PRODUCTION IN TONS				
Year	Pig Iron	Steel	Zinc	Lead
1913	2,484,690	2,466,630	204,220	103,480
1914	1,454,490	1,396,300	145,925	70,980
1915	68,150	98,890	51,660	16,770
1916	127,825	99,371	22,930	15,560
1917	7,990	9,530	10,290	22,745
1918		10,540	9,245	20,630

The last Belgian blast furnace in operation was shut down in April, 1917. The production of steel in 1917 and 1918 was possibly due to the use of scrap iron as raw material and to two plants of the Province of Hainaut which for some reason enjoyed the particular good will of the Germans.

#### RECONSTRUCTION OF THE BELGIAN METALLURGICAL INDUSTRY

What this work implies may be surmised from the following table relating to the principal plants:

	Status Before the War, 1914	Status After the War In Working Condition
Coke ovens	2,554	993
Blast furnaces	59	4
Converters	49	8
Martin furnaces	26	19
Rolling mills	108	23

The smaller plants have undergone a similar fate.

The reconstruction work is making headway. Thus an official report stated that at the end of 1919 the iron and steel industries employed 60 per cent of the pre-war-time force, of which a great part was devoted to reconstruction work, and produced 34 per cent of the normal tonnage of iron products. During the same period the coke-oven plants employed 53 per cent of their pre-war force and produced 37 per cent of the normal coke tonnage.

The Belgians encounter many hardships in the struggle to revive their metallurgical industries. Among these hardships may be cited the depreciation of the money, labor conditions, lack of raw materials and what may be called *reverse dumping*. This consists in selling products at low prices in the country where produced and charging exorbitant export prices. Although these conditions handicap rapid recovery, the Belgians are working hard for the aim in view.

## Synopsis of Recent Chemical & Metallurgical Literature

**Composition of Coal Gas Obtained at Different Temperatures.**—In studying the composition of coal gas obtained by the distillation of different coals at temperatures varying between 400 and 1,200 deg. C. and maintaining the temperatures at 600, 800, 1,000 and 1,200 deg. C. for some time and until only very small quantities of gas continue to distill at the considered temperature, LEO VIGNON (*Annales de Chimie*, May-June, 1920, pp. 288-292) has arrived at the following conclusions:

1. The unsaturated hydrocarbons  $C_2H_2$ ,  $C_2H_4$ ,  $C_2H_6$  distill at below 600 deg. C.; at higher temperatures these hydrocarbons are broken up.
2. Methane and saturated hydrocarbons distill up to 800 deg. C. in very great quantities—namely, 60 to 84 per cent—but this percentage diminishes rapidly at a higher temperature.
3. The percentage of hydrogen in the distilled gas is from 2 to 25 up to 600 deg., is more abundant in the gas distilling between 800 and 1,000 deg., but decreases with gas obtained between 1,000 and 1,200 deg.
4. The percentage of carbon monoxide in the distilled gas varies between 3 and 11 (with an average of 6.5) according to the coal used, up to 850 deg. C. At temperatures above 1,000 deg. C. this percentage may reach 30 and even more.
5. By increasing the temperature of distillation the total volume of gas distilled increases, but the gas obtained at over 1,000 deg. C. has a low calorific value and contains in general great quantities of carbon monoxide.

**Annealing Electrolytic Iron.**—It is known that electrolytic iron contains quantities of hydrogen when leaving the electrolytic bath and that this gas forms hydrides, which are easily detected with the microscope, resulting in an increase of hardness. JEAN COURNOT

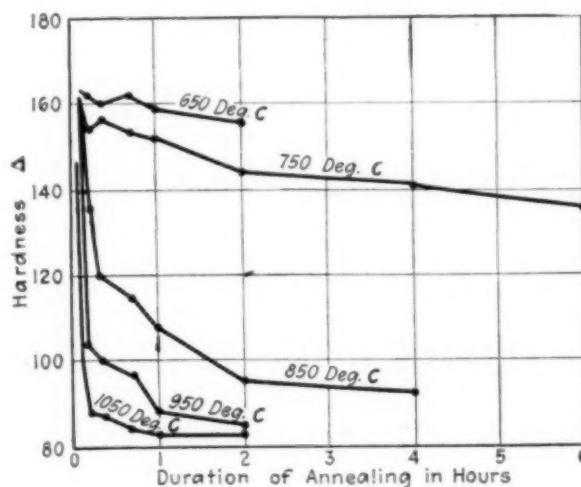
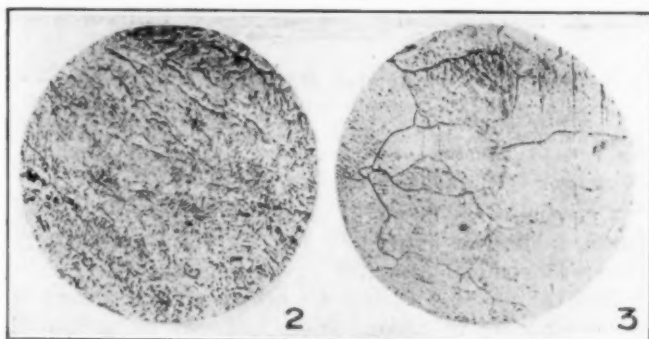


FIG. 1.

has worked out the necessary heat treatment for eliminating this hydrogen. He experimented upon test pieces, 6 cm. x 4 cm. in area, from a cathode sheet



FIGS. 2 AND 3.  $\times 350$ 

6 mm. thick, varying the time and temperature of annealing.

Brinell hardness as a function of time and temperature of annealing is shown in Fig. 1, from which it can be seen that during the first ten minutes of annealing there is a rapid fall in hardness, this the more rapid the higher the temperature. The limiting hardness is about 83, which is reached only after many days at temperatures below 850 deg. C., two hours at 950 deg. C. or one hour at 1,050 deg. C.

Micrographic results are as follows: After one hour heating, the sample polished and etched for twenty seconds by a 4 per cent solution of nitric acid in alcohol shows generally a polyhedric structure. Fig. 2 shows the sample before annealing, and Fig. 3 the sample after one hour. (*Génie Civil*, Aug. 7, 1920, pp. 118-119.)

## Recent Chemical & Metallurgical Patents

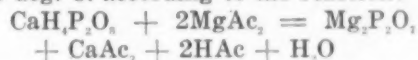
Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

**Ductile Nickel-Cobalt Alloy.**—COLIN G. FINK has found that the non-ductility at ordinary temperatures of the alloys of nickel and cobalt is due to the presence of carbon in the alloy, and that such an alloy free from carbon, sulphur, phosphorus and basic impurities is ductile. An alloy containing twenty to thirty parts by weight cobalt and eighty to ninety parts nickel is produced in an electric furnace of the Coolidge type in an alundum crucible, special precautions being taken to prevent contamination with carbon, sulphur, etc., and when melted about two parts of manganese is added. The alloy may be rolled from 0.5 in. to 0.02 in. without intermediate annealing and is particularly suitable as a supporting and current lead wire for electric incandescent lamps, as it has but slight tendency to volatilize and spatter electrically. It has a low heat conductivity and therefore increases the efficiency of electric lamps, particularly in the case of miniature low voltage lamps. (1,342,993; assigned to General Electric Co., June 8, 1920.)

**Cyanides From Ferrocyanides.**—Ferrocyanide material—such as Bueh sludge obtained by treating coke-oven gas with ferrous sulphate—is added slowly to a boiling acid solution containing a small amount of finely divided copper. The acid used may be either  $H_2SO_4$  or

HCl. If the former is used, a small amount of  $NH_4Cl$  or other chloride is added to accelerate the reaction. While the ferrocyanide is being introduced, an equivalent quantity of acid is added until the solution becomes concentrated with iron sulphate or chloride. The feed of ferrocyanide is continued as long as it is completely decomposed, thus practically neutralizing the free acid. At this stage copper cyanide is precipitated and this together with the residue of metallic copper is filtered off and returned to the still for the treatment of the next batch. The vapors from the still pass through condensers and fractionating columns which separate the water and discharge it outside of the apparatus so that the capacity of the still is increased and a more concentrated solution of ferrous sulphate and ammonium sulphate obtained. The HCN which passes on through the column is absorbed in alkali to form cyanides. (1,347,518; MAX E. MUELLER, of Youngstown, Ohio; July 27, 1920.)

**Pyrophosphates.**—HYLEMAN A. WEBSTER, of Columbia, Tenn., has been granted a patent on a process of producing pyrophosphates without fire. He precipitates magnesium pyrophosphate from an acid solution of mono-calcium phosphate (20 deg. Bé.) and magnesium acetate at 60 deg. C. according to the reaction:



The process used in the arts is according to the following reaction:

$NaH_2PO_4 + MgCl_2 + NH_3 = NH_4MgPO_4 + 2NaCl$  which upon heating to fusion temperatures =  $Mg_2P_2O_7 + 2NH_3 + H_2O + 2NaCl$ . As the acetic acid is worked in a cycle and would only suffer a percentage loss, it is apparent that the new process is the more economical. (1,346,148; July 13, 1920.)

**Refractory Compound of Carbon and a Silicate Mixture.**—A. J. HINCKLEY, of Niagara Falls, N. Y., produces a highly refractory article by combining fully shrunken and carefully graded carbon with high-grade fireclay. Hard coal is preferably used and should be as free as possible from laminations; this is calcined in an electric furnace to produce a fully shrunken product, which is graded by carefully screening out the over- and under-sized particles. The volume of the interstitial space is calculated and high-grade fireclay added in just sufficient quantity to fill the interstitial space. Water is then added to produce a plastic mass. After thorough pugging the heavy paste is ready for use. It is extruded under heavy pressure or may be tamped into place to form a furnace lining. After preliminary drying the article is burned at approximately 1,000 deg. C. The approximate volume ratio is 53 parts graded carbon particles to 47 parts finely ground fireclay; the carbon particles for a standard 9-in. brick are approximately 0.03 in. in diameter.

The product has a distinct electrical conductivity, the specific resistivity is of the order of 0.04 ohm. per c.c. It is mechanically strong and does not shrink or crack on exposure to very high furnace temperatures. At furnace temperatures higher than 1,000 deg. C. silicon carbide will be formed, this transformation producing an extremely refractory article. (1,346,959; July 20, 1920.)

**Removal of Cobalt From Zinc Solution.**—The usual treatment for the removal of impurities from the solution obtained by leaching zinc calcine with spent elec-

trolyte does not completely remove cobalt, the presence of which most adversely affects the subsequent electro-deposition of the zinc. DAVID AVERY and R. J. D. WILLIAMS have discovered that if the solution is treated with limestone for the precipitation of the iron and with finely divided zinc dust for the precipitation of any silver, arsenic, antimony, copper or cadmium that may be present (the usual method), the presence of arsenic more effectively secures the removal of cobalt. It is necessary to have a soluble arsenic compound present after the treatment with limerock; the treatment is more effective if the solution be heated to about 60 deg. C. and the addition of the zinc dust be made in stages. For complete removal of the cobalt a soluble compound of copper is also necessary and the presence of a small quantity of free sulphuric acid facilitates the precipitation. The agitation of the solution should be made without the access of air. (1,347,200, assigned to the Electrolytic Zinc Co. of Aust. Prop. Ltd.; July 20, 1920.)

**Refining of Metal in Electric Furnace.**—When refining steel in an electric furnace of the Heroult type it is necessary, in order to operate economically using the basic process, to charge the furnace with molten metal and refine with low voltage arc. This low voltage limits the length of the arc, and a current of relatively high amperage is initially required to properly refine the charge. Following this treatment the amperage is reduced and treatment continued with a reduced power input at practically the initial voltage. This method of operation is slow and uneconomical, unless the metal be added in the molten state, and to be able to refine a solid charge it has been necessary to use a longer arc at a higher voltage; this brings up the output but introduces difficulty from the overheating of the walls and roof of the furnace.

In order to overcome these and other difficulties R. H. BULLEY, of Syracuse, N. Y., has developed a method of treatment which consists of initially applying a high-voltage relatively long arc to the charge and then reducing the length of the arc, at the same time keeping the kilowatt load practically constant. Suitable transformer and regulator equipment is described. (1,347,838; July 27, 1920.)

**Electrolytic Concentrating Table.**—H. H. GODFREY combines the action of a shaking concentrating table and that of electrolysis for the extraction of metals from ores. The bed of the table consists of a cathode and is made of a suitable material. At an adjustable distance above and parallel to the bed is a plate which constitutes the anode. The material to be treated is made into a pulp by the addition of a suitable electrolyte. (July 20, 1920; 1,347,026.)

**Method of Producing Tungsten Alloys.**—In the manufacture of tungsten steel considerable difficulty as well as a material loss of tungsten is experienced in adding the tungsten powder, the most suitable form of this metal, to the molten metal. Many methods have been tried to overcome these difficulties. J. H. DEPPELER has found that it is possible to compress the tungsten powder into dense coherent tablets and that these when added to a molten bath of the alloying metal sink to the bottom of the bath, the addition being accomplished without material loss of tungsten. (1,350,709, assigned to the Metal & Thermit Corp.; Aug. 24, 1920.)

## British Patents

Complete specifications of any British patent may be obtained by remitting 25c. to the Superintendent British Patent Office, Southampton Buildings, Chancery Lane, London, England.

**Cymene.**—*p*-Cymene is prepared from residual terpenes, boiling at about 175 deg. C., from the manufacture of artificial camphor or pine-needle oil fractions boiling at about 175 deg. C., which consist essentially of *i*-limouene, by chlorination followed by steam distillation of the product. The *p*-cymene may be purified by treating with zinc chloride or other condensing agent or oxidizing-agents such as potassium permanganate. (Br. Pat. 142,738—1919. BRITISH & FOREIGN CHEMICAL PRODUCERS LTD., London, July 7, 1920.)

**Organo-Metallic Compounds.**—Aromatic arsenic acids are obtained by the reaction of aromatic diazo compounds upon acids, neutral, or alkaline aqueous or dilute alcoholic solutions of arsenious acid, in the presence of a copper salt and a reducing-agent appropriate to the medium used. Suitable reducing-agents are: for acid solutions, hypophosphorous acid or a mixture of sodium hypophosphite and hydrochloric acid, or cuprous hydrate; for neutral solutions, sodium hydrosulphite or sodium formaldehyde sulfoxylate; for alkaline solutions, sodium hydrosulphite, formaldehyde hydrosulphite, or formaldehyde sulfoxylate, or the sodium arsenate itself used in excess. The process may be carried out in cold or at a moderate temperature; when working in acid solution, the diazo compound may be replaced by the aromatic amine in conjunction with sodium nitrite. Examples are given of the preparation of phenylarsinic acid in acid, neutral, and alkaline solutions, using copper sulphate as the copper salt, sodium arsenite  $\text{Na}_2\text{HAsO}_3$  or a solution of arsenious acid in caustic soda or sodium carbonate solution as the source of arsenic, and sodium hypophosphite, sodium hydrosulphite, or the excess of sodium arsenite as the reducing-agent in the acid, neutral, or alkaline solutions respectively. The following products are specified also: *p*-methylphenylarsinic acid, *p*-chlor-phenylarsinic acid, *p*-chlor-*m*-nitrophenylarsinic acid, *p*-bromophenylarsinic acid, *p*-brom-*m*-nitrophenylarsinic acid, *p*-methoxyphenylarsinic acid, *p*-methoxy-*m*-nitrophenylarsinic acid, *p*-ethoxyphenylarsinic acid, *p*-ethoxy-*m*-nitrophenylarsinic acid, phenylsulphonyl-*p*-aminophenylarsinic acid, *p*-oxyphenylarsinic acid, *p*-oxy-*m*-nitrophenylarsinic acid, and *p*-oxy-*m*-urethanophenylarsinic acid. Sodium arsenite of the formula  $\text{Na}_2\text{HAsO}_3$  is obtained by fusing arsenious oxide with two molecular parts of sodium carbonate, in absence of air, dissolving the product in water, evaporating to a sirupy consistency, and allowing to stand for some time at 30-40 deg. C. (Br. Pat. 142,947—1919. A. MOUNEGRAT, Paris, France, July 14, 1920.)

**Indophenols.**—Indophenols are obtained by finely grinding and intimately mixing together equi-molecular parts of *p*-nitrosophenol and the free bases diphenylamine carbazole or other amines yielding indophenols, and introducing the mixture slowly with stirring into cold concentrated sulphuric acid. Liquid amines such as *o*-toluidine are similarly mixed to a paste with *p*-nitrosophenol, and the paste treated as described above. The indophenol from *p*-nitrosophenol and phenol is prepared similarly. The provisional specification also describes a process in which *p*-nitrosophenol is ground and mixed with the sulphate of a liquid amine as *o*-toluidine, and



further treated as above. (Br. Pat. 143,014—1919. BRASSARD & CRAWFORD, Wakefield, Yorkshire, and E. A. BUCKLE, Westminster, July 14, 1920.)

**Treating Lead and Silver Ores.**—The lead and silver in complex sulphide ores containing zinc such as Broken Hill ores are treated by mixing the ore with hydrochloric in quantity sufficient for the desired reaction, and heating to a temperature above 100 deg. C. The ore is mixed with the acid, dried at a temperature below 100 deg. C., and heated at a higher temperature which may be 500 to 600 deg. C., preferably in a closed vessel. The operation is facilitated if some copper is present in the ore. The mixture of ore and acid may be allowed to stand some time before drying, and the furnace product may be moistened and left for some time before leaching. The product may be leached with hot brine containing some ferric chloride to dissolve both lead and silver chlorides with a minimum time of contact between liquor and ore. (Br. Pat. 142,854—1919. AMALGAMATED ZINC (DE BAVAY'S), LTD., Melbourne, Australia, July 14, 1920.)

**Chloropicrin.**—Consists in preparing this by the action of chlorine or picric acid or other suitable nitro-derivative of a phenol or of a naphthol in the presence of water and a basic material, such as metallic oxides, carbonates, or borates, preferably sodium or potassium hydroxide or carbonate. The basic material may be added in successive stages or wholly at the beginning. The temperature is preferably kept below normal atmospheric pressure. (Br. Pat. 142,878—1919. K. J. P. ORTON, University College, Bangor, Carnarvonshire, and W. J. POPE, University Cambridge, July 14, 1920.)

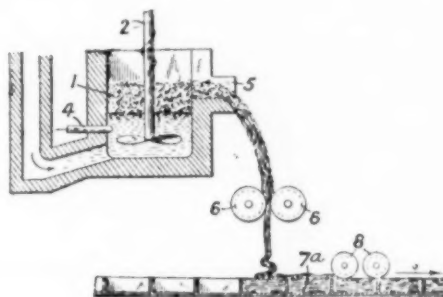
**Arylarsenious Halides.**—Monoarylarsenious halides are obtained from di- or tri-arylarsines by treatment with arsenious halides; and diarylarsenious halides are also obtained from triarylarsines by treatment with monoarylarsenious halides or with arsenious halides. Solvent and catalysts may be added. On a large scale, mono- and di-arylarsenious chlorides are obtained by vaporizing arsenious chloride and passing the vapor through or over the surface of the molten triarylarsine. In other cases, the reaction is performed by heating a mixture of the ingredients in an autoclave or under atmospheric pressure. (Br. Pat. 142,880—1919. W. J. POPE, The University, Cambridge, July 14, 1920.)

**Treating Rubber Tree Bark.**—Bark shavings from rubber trees are ground and masticated between rollers heated to about 275 deg. F., so as to knead the rubber with the bark and convert the whole into a dough-like or plastic mass. The product, after being mixed with a vulcanizing-agent and vulcanized, is suitable for the manufacture of tapping-cups, coagulating-dishes, floor matting, etc. Alternatively, the vulcanizing agent may be added prior to grinding, and the raw material may be treated in a scrap-washer and creping machine in the known manner for the extraction of raw rubber. (Br. Pat. 142,926—1919. R. T. SMITH, London, July 14, 1920.)

**Recovering Material From Linoleum Scrap.**—In a process for working up linoleum scrap into new linoleum by treating with organic solvents, only sufficient solvent is used to soften the scrap and enable the jute fibers to be separated by mechanical means from the softened mass of binding cement, ground cork, coloring matter, etc. For example, 1,000 kg. of broken up lino-

leum scrap is treated with 500 kg. of alcohol in an autoclave for about two hours at a temperature of 80 to 140 deg. C., resulting in the reduction of the scrap to a soft crumbly pulp. The alcohol is then distilled off, and the pulp is fed on to vibrating sieves to separate the jute fibers from the linoleum pulp. The regenerated substance is finally heated to a temperature of 100 to 120 deg. C. to restore the qualities of toughness and glutinousness of the binding cement, which had been depolymerized during the treatment with the solvent. (Br. Pat. 143,561—1919. V. SCHOLZ, Jauer, and C. TIEDEMANN, Coswig, both in Germany, July 28, 1920.)

**Treating Slag.**—Molten slag is converted into foam by blowing steam or other gas through it, and this foam is rapidly cooled to a temperature at which the slag is still plastic, but the porosity becomes stable, the resulting material being molded into bricks or the like and allowed to solidify. In an example, a slag



having the composition 50 per cent silica, 15 per cent alumina, 30 per cent lime and 5 per cent magnesia is introduced into a vessel 1 provided with a stirrer 2, at a temperature of about 1,400 deg. C. Water or steam or other gas is introduced through an opening 4, and, on stirring, a foam is produced at a temperature of about 1,000 deg. C, which flows through a conduit 5 on to water-cooled rollers 6, whence it emerges as a ribbon at about 800 deg. C., which falls into cast-iron molds on a conveyor 7<sup>a</sup> which moves in the direction of the arrow. Rollers 8 level the surface and remove any excess of foam. The foam may be further cooled by an air or like blast between the rollers 6 and the molds. If objectionable gases are produced during the conversion into foam, the operation should be carried out in an oxidizing atmosphere. (Br. Pat. 143,500—1919. NORSKE AKTIESELSKAB FOR ELEKTROKEMISK INDUSTRI, Christiania, July 21, 1920.)

**Waterproofing Paper.**—Paper is waterproofed and rendered impervious to air so that it may be used as a substitute for rubber or leather for making diaphragms for gas meters and gas lighters, or for the manufacture of purses, etc., by impregnation with a warm solution of animal and vegetable glutinous substances, followed, after drying, by rubbing in fat, whale oil, etc. Long-fibered paper, such as japan paper, is preferably employed. A suitable impregnating solution consists of gelatine 2 parts, agar-agar or arrowroot 1 part, potassium bichromate 0.5 part, calcium chloride or glycerine 3 parts, and ammonium carbonate for reducing flammability 3 parts, all dissolved in 100 parts of water. Gelatine alone may be used when brittleness is not objectionable, and the after treatment with fat or oil is necessary only when the material in use is alternately wetted and dried. (Br. Pat. 143,235—1919. L. HEILBRONNER, Stuttgart, July 21, 1920.)

**Anthraquinone.**—Crude anthraquinone is purified by heating it dissolved in an inert solvent with alkaline substances (aqueous solutions of caustic alkalis, alkali carbonates, calcium hydroxide, etc.) or sulphuric acid; chlorbenzene or coal-tar naphtha are specified as suitable solvents. (Br. Pat. 143,885—1919. KINZLBERGER & Co., Prague, Czechoslovakia, July 28, 1920.)

**Acetaldehyde.**—In the manufacture of acetaldehyde by passing acetylene into acid solutions containing mercury salts, the catalyst is continuously regenerated in the reaction liquid by electrolytic oxidation, the arrangement being such that excess of metallic mercury is always present at the anode. The reaction liquid may contain large quantities (over 10 per cent) of mercury salt, the rapid reduction of such concentrated solutions to mercury being offset by the anodic oxidation of the reduced mercury. Examples are given in which (1) the liquid contains at the commencement both dissolved mercury salt and a mercury anode; (2) the liquid at the start contains only mercury salt, the reduced mercury collecting and being oxidized at a platinum anode; (3) the liquid at the start contains only a mercury anode, the current of acetylene not being passed until sufficient mercury salt has been formed by the electrolysis. Sulphuric acid is employed as reaction liquid in the above-mentioned examples, but other inorganic or organic acids may be used. The cathode may be of mercury, lead, platinum, etc., and may be enclosed in a diaphragm chamber or not. (Br. Pat. 143,891—1919. CHEMISCHE FABRIK GRIESHEIM-ELEKTRON, Frankfurt-on-Main, July 28, 1920.)

**Artificial Filaments and Fabrics.**—An artificial textile fabric is made from filaments prepared from solutions of, for example, viscose, cuprammonia cellulose, collodion, gelatine or cellulose acetate, and in which are incorporated bubbles of air or inert gas; fabrics manufactured of such hollow filaments are very light, opaque and soft to the touch. The introduction of air, etc., bubbles is effected by forming an emulsion of the selected solution and air—for example, by directly blowing in air, or by means of injectors, or by heating devices—and the emulsion can be made more permanent by the addition of soap, albumen, gelatine, etc. The process is applicable to the manufacture of continuous filaments such as threads for spinning, or films, plates or bands, and also of non-continuous filaments such as tops and noils. (Br. Pat. 143,253—1919. L. DRUT, Villeurbanne, France, July 21, 1920.)

**Fibrous Compositions.**—Vegetable fibers are mixed with casein in the form of paste and the mixture is molded under pressure and heat. In an example, fibers are immersed in a bath containing one kilo of casein paste consisting of 88 per cent casein and 12 per cent ammonia to 15 liters of water. The fibers are drained, placed in molds, compressed, and heated to about 130 deg. C. to drive off the water and ammonia. Lime, carbonate of magnesia, borate of soda, etc., may replace the ammonia. Articles may be ornamented by coating them with sawdust before molding. (Br. Pat. 143,258, 1919. E. E. MOUGEON, Montoux, France, July 21, 1920.)

**Dialkyl Sulphates.**—Dialkyl sulphates are prepared by the reaction of sulphur trioxide as such or in the form of fuming acid, upon the alcohols in the presence of dehydrating-agents—e.g., phosphorus pentoxide or anhydrous sodium or copper sulphate; diluents such as

carbon tetrachloride may be added; the product of the reaction is worked up by distillation *in vacuo*, extraction by solvents, etc. Examples are given of the preparation of diethyl sulphate. (Br. Pat. 143,260—1919. L. LILIENTHAL, Vienna, July 21, 1920.)

**Purifying Fats, etc.**—Edible oils, fats and the like are purified by converting any fatty acids present into glycerides *in situ*. In an example, 1 lb. of palm or coconut oil and 2 lb. of glycerine, with a contact substance, such as kieselguhr or titanium dioxide deposited on kieselguhr, are sprayed or agitated together in a vessel maintained at about 140 deg. C. and under a vacuum of about 28 in. for, say, fifteen hours. The product is allowed to settle and the oil decanted, washed with water and filtered. Hydrogenation, deodorization and purification as described in Specification 135,295 may proceed at the same time or after esterification. (Br. Pat. 143,321—1919. G. CALVERT, Twickenham Park, Middlesex, July 21, 1920.)

**Dyeing With Mordant Dyes.**—Meta-tungstic acid or compounds or salt thereof—e.g., phosphotungstic acid, silicotungstic acid or antimony-tungstic acid—are employed in dyeing textile fibers, paper, wood, leather, gelatine, etc., with acid dyes containing amino and sulphonic groups; either the tungstic acid compound is added to the dye-bath or the dyeing is after-treated therewith. The tungstic acid compounds are also used in making lakes from the dyes in question. Examples are given of the dyeing of wool, paper pulp, and leather, and of the manufacture of barium-aluminum lakes, phosphometatungstic acid being used in each case. (Br. Pat. 143,242—1919. FARBENFABRIKEN VORM. F. BAYER & Co., Leverkusen, near Cologne, July 21, 1920.)

**Gray Iron.**—In the production of gray iron in two stages, a white iron is first obtained by smelting at a temperature of 1,200 to 1,300 deg. C. and the product is refined in an electric or other furnace at a temperature of 1,500 deg. C. with additions of carbon and silicon. The white iron, if smelted in an electric furnace, contains carbon 2 per cent, silica 0.5 per cent and sulphur 0.3 per cent; when a blast furnace is used the iron contains 3 per cent of carbon. The refined product contains 3 per cent of carbon and 1.5 per cent of silicon. (Br. Pat. 143,596—1919. G. J. STOCK, Bradford, Yorkshire, July 28, 1920.)

**Purifying Coal Gas.**—Carbon disulphide, thiophene and similar impurities in coal gas are dissociated to form sulphuretted hydrogen by passing the heated gas over heated alumina, bauxite or ignited magnesite. The sulphuretted hydrogen is then removed from the gas by the usual methods. When the efficiency of the material has become impaired, owing to the deposition of carbon, it may be revived by the passage of air over the heated mass. (Br. Pat. 143,641—1919. F. W. BERK & Co. and J. J. HOOD, both of London, July 28, 1920.)

**Cementation.**—A mixture used in the cementation of iron and steel at a temperature of 700 to 800 deg. C. contains potassium ferro and ferri cyanides, potassium chromate or bichromate, and charcoal. Large articles are preferably preheated before insertion into the mixture. The metal may afterward be hardened in a bath containing seasalt together with ammonium chloride or caustic soda, or both. (Br. Pat. 143,746—1919. M. L. M. LUTTENSCHLAGER, Mulhouse, July 28, 1920.)



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## Current Events

### in the Chemical and Metallurgical Industries

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#### Sub-Committee on Standardization of Petroleum Specifications to Convene

The Technical Sub-Committee of the Committee on Standardization of Petroleum Specifications, appointed some time ago by President Wilson, will hold a meeting at the offices of the Bureau of Mines, Washington, D. C., on Monday, Oct. 18, at 10 a.m., to give further consideration to Government specifications on gasoline, kerosene, fuel and lubricating oils. The meeting is to be open to all persons interested, and it is the desire of the committee that as many representatives of the oil refining and automotive industries as possible be present.

Dr. G. W. Gray, of New York, chairman of the committee, particularly requests that any refineries who feel that the present specifications may be unjust send their technical men to this meeting, as the committee intends to take up all the specifications for petroleum products that have been issued up to the present time with a view to possible revisions. This includes the specifications for Government purchase of gasoline, kerosene, fuel and lubricating oils.

The committee also plans to consider new specifications for lubricants and other products.

#### Coal-Tar Trust Formed in Germany

Official advices reaching Washington tell of the formation in Germany, under legal authority, of an economic union to regulate the coal-tar trade. The organization is composed of practically all concerns engaging in the coal-tar industry. The organization is to supervise import and export matters, but is precluded from reducing importations for the purpose of maintaining high levels or prices in Germany. A committee has been appointed to fix prices at which coal tar, tar oil and briquet tar are to be sold. Another committee is to decide what amount of crude tar is to be assigned to the various plants.

Only such plants will be recognized as legal refineries as conform to certain technical standards and agree to abide by prevailing prices.

The formation of this union is regarded as very significant by some officials in Washington since they see in it a continuation of Germany's pre-war methods of meeting competition abroad.

#### Plenty of Cars for Fertilizers

Through an arrangement made between the National Fertilizer Association and transportation authorities the movement of fertilizers during the season just closed was highly satisfactory despite the transportation shortage. Under the agreement box cars were to be furnished for 75 per cent of each plant's daily requirements. To offset the smaller number of cars furnished the shipping season was begun one month earlier. By extending the season the entire tonnage was moved to the complete satisfaction of the National Fertilizer Association.

#### Working for Soil Improvement

The work of the Soil Improvement Committee of the National Fertilizer Association is to be expanded materially. The main office of the committee has been moved from Chicago to Washington. A branch office will be continued in Chicago, but the Baltimore office of the committee has been closed. W. D. Hurd is the director of the committee. The main function of Dr. Hurd's organization is to encourage the proper use of fertilizer and to conduct an educational campaign among the farmers of the country looking to the more general recognition of the importance of fertilizers in economical farm management.

Dr. Hurd is of the opinion that fertilizers are going to be called upon to play an increasingly important part in agriculture, due to the increase in labor and other costs. Each year more farmers become aware that there are few soils which possess all the constituents for the maximum plant growth. During the transportation shortage and other conditions arising out of the war fertilizers have not been used to the extent necessary. As a result the demand for fertilizer is expected to increase very materially as soon as conditions are nearer normal.

One of the matters now receiving particular attention by the Soil Improvement Committee is the effort to bring home to the farmer the advantage of purchasing high-analysis fertilizers in preference to those of low analysis. There is an additional reason for urging such purchases since the increase in freight rates because the more concentrated product is relatively cheaper to transport.

#### Industrial Information Bureau in China

Of interest to those who do, or desire to do, business in China is the announcement that beginning with February, 1921, the Government Institute of Technology at Shanghai, China, will open a Bureau of Information for Alumni. The school is under Chinese Government support and prepares engineers and railway administration men with a technical education equivalent to that of an engineering school. These men often are located away from the port cities, and when they desire information regarding equipment they find it difficult to obtain it. To meet this need the school is about to open this bureau. Manufacturers who are interested are invited to send catalogs, specifications, designing data, approximate costs, samples or models. In case samples are sent an attempt will be made to place them in running order. No sales will be made or attempted. Impartial information alone will be offered.

A member of the faculty is now in America on leave and he will be glad to communicate further with any who desire information regarding the Chinese field. Address H. A. Vanierbeck, 5 Canmann Pl., Somerville, N. J., until Dec. 1, 1920, and Box 951 U. S. P. O., Shanghai, China, after that date.

### Exports of Dyes and Dyestuffs From the United States

Dyes and dyestuffs exported from the United States to the various countries during August amounted to \$2,111,095, of which \$1,151,196 worth was aniline dyes and \$336,718 worth was logwood extract. China was by far the largest importer of these goods, the trade being valued at \$547,311. Exports to England amounted to \$318,332. The value of the exports of dyes and dyestuffs to the various countries from the United States during August, 1920, is shown in the following table:

Countries	Aniline Dyes	Logwood Extract	All Others
Belgium	\$73,765	\$4,557	\$9,000
Denmark	1,749	1,553	664
Finland	2,060		
France		57,581	19,756
Greece	7,848		4,688
Italy	46,989	88,969	9,697
Netherlands	416	8,069	940
Norway	1,644		
Portugal	9,746	3,000	10,424
Spain	4,748	4,670	19,329
Sweden	27,857		290
Switzerland	2,860	3,462	3,500
Turkey in Europe	3,500		
England	41,617	130,759	145,956
Scotland	1,400		14,507
British Honduras			18
Canada	96,957	17,747	78,756
Costa Rica			580
Guatemala			16
Honduras			31
Nicaragua			30
Panama			1,245
Salvador	1,100	13	8
Mexico	99,957	428	5,064
Newfoundland and Labrador			1,555
Trinidad and Tobago	17		106
Cuba	3,873	7,568	1,240
Dominican Republic	1,338		
Argentina	81,931		19,274
Brazil	41,045	1,453	14,492
Chile	4,700		627
Colombia	6	100	870
Ecuador	1,977	50	109
British Guiana			130
Peru	17,303	145	252
Uruguay	3,291		
Venezuela	1,742		
China	366,893	84	180,334
British India	77,935		34,956
Straits Settlements	240		959
Dutch East Indies	1,060		
French Indo China	9,400		
Hongkong	71,916		28,474
Japan	33,454	3,000	8,744
Turkey in Asia			1,060
Australia		3,510	1,318
New Zealand	379		158
Philippine Islands	5,800		1,985
British South Africa			2,197
British East Africa			650
Egypt	2,683		
Total	1,151,196	336,718	623,181

### Chemical Manufacturers Participating in Crop Protection Institute

Eleven manufacturers of insecticides and fungicides have already indicated their desire to become company members of the Crop Protection Institute, organization of which was completed under the auspices of the National Research Council on Sept. 28. This organization has planned to foster research and co-operation in plant life protection, use of insecticides and fungicides, and similar or related activities. The officers who are serving at present are: Chairman, W. C. O'Kane, New Hampshire State Entomologist; secretary, H. E. Howe, National Research Council; treasurer, G. R. Cushman, General Chemical Co. The board of trustees will be made up of thirteen persons appointed as follows: Three by the American Association of Economic Entomologists, three by the American Phytopathological Society, two by the Association of Official Agricultural Chemists, one by the National Research Council, three by manufacturers of insecticides and fungicides and one by the manufacturers of equipment and supplies used in this industrial work.

### Additions to Carnegie Tech Faculty

The faculties of the division of science and engineering and of the division of industries of the Carnegie Institute of Technology have been strengthened this year by a large number of new appointees. In the division of science and engineering are C. R. Clutter, Lauren C. Hand and Frank E. Rupert, instructors in chemical engineering; R. W. Boreman, W. H. Michner and A. Press, instructors in physics; Charles A. Blodgett and Fred J. Evans, instructors in civil engineering; W. S. McKee, instructor in machine design; David C. Saylor, instructor in mechanical engineering; W. A. Copeland, instructor in metallurgical and mining engineering; W. Z. Price, assistant professor in mining engineering, and C. G. Simpson, instructor in the mechanics department. In the division of industries are Charles B. Walker and F. N. Talley, instructors in chemistry, and James Creech, instructor in presswork, in the printing department.

### May Load Less Phosphate Rock

Loading and unloading requirements applying to phosphate rock have been reduced on Shipping Board vessels. This concession is the result of conferences, extending over several months, between officials of the Shipping Board and of the National Fertilizer Association.

Prior to the new arrangement it was necessary to load and discharge vessels at the rate of 1,200 tons daily. In the future the requirement will be 1,000 tons daily in loading vessels and 800 tons daily in removing the cargo.

The new regulation affects the large tonnage of phosphate rock which moves in coastwise traffic from Tampa, Port Tampa and Boca Grande, Fla., to Savannah, Charleston, Wilmington, Norfolk, Baltimore, Philadelphia, Carteret, N. J., and Boston.

## Personal

E. B. BALL, Assistant Secretary of Agriculture, spoke before the Chicago Chamber of Commerce recently on the world food supply's dependence on science.

Dr. G. HOWARD CARTLEDGE has recently been appointed associate professor of chemistry in Johns Hopkins University.

CLINTON V. CONLEY, who received his master's degree at the University of Chicago this month, is now research chemist for Procter & Gamble Co., Cincinnati, Ohio.

HERBERT HOOVER has been appointed a member of the advisory board for the Eastern Industrial Region Superpower Survey, now being conducted by the Geological Survey. Mr. Hoover will serve as consulting mining engineer on the board, which is assisting the Government in the development of plans for a vast superpower system stretching from Boston to Washington and designed to supply electrical power to railroads, public utilities and private industry throughout that territory.

Dr. OLIVER KAMM has resigned his position as assistant professor in organic chemistry in the University of Illinois in order to accept one as director of research for Parke, Davis & Co., of Detroit, Mich. Dr. Kamm was formerly chief of the research section of the department of technical control of the American Writing Paper Co., Holyoke, Mass., and still retains his connection with that company as a member of its consulting staff.



Dr. A. B. MACCALLUM, formerly administrative chairman of the Honorary Advisory Council for Scientific Research of Canada, has been appointed professor of biochemistry at McGill University, Montreal, Canada.

R. J. QUINN has recently been appointed Chicago district sales manager of the Mathieson Alkali Works, with an office at Room 617, Webster Bldg., 327 South La Salle St. The plants of this company are located at Niagara Falls and at Saltville, W. Va.

HENRY N. THOMSON, at one time head chemist for the Anaconda Co. and later superintendent of International Smelter, Tooele, Utah, has been appointed to the chair of metallurgy, University of British Columbia, Vancouver.

The following have become members of the staff of the department of chemistry of the College of the City of New York: Wyly McGee Billing, Harry P. Coats, Alexander Cohen, Alexander C. Glennie, Nathan Hecht and Foster D. Snell.

Additional appointments of research associates at the Bureau of Standards have been made as follows: E. N. Turnquist and G. G. Sward, appointed by Sears, Roebuck & Co., to study methods of standardization of mechanical devices and physical properties of products and standardization of commercial articles from a chemical basis. H. M. Westergaard, by the American Concrete Association, to work on investigation of flat-slab concrete and tile structures. C. J. Whittlesey, by the Gypsum Industries Association, to work upon the properties of gypsum products. J. P. Cockey, by the Super Cement Co., Ltd. (America), to participate in oil investigations in connection with cement.

## Current Market Reports

### The Iron and Steel Market

*Pittsburgh, October 8, 1920.*

The iron and steel market, generally speaking, is losing strength at the moment more rapidly than was expected. That a general readjustment had begun was recognized some time ago, but of late it has been thought that the momentum of the industry would carry it through the year or perhaps through the winter, with respect to tonnage output. By a close analysis it may be taken that the real turning point occurred as early as June 1, buying since then having been on a conservative scale, except that on account of the Steel Corporation quoting much lower prices than the independents its business kept up, no decrease in unfilled obligations being shown until the month of August. In the case of pig iron there were advances in nearly all districts in August, but the buying movement was extremely small, and the price advances could almost be said to be simply "on paper." The advanced prices were at any rate paid in few cases except for very early deliveries, so that in essence they represented a delivery premium.

Even should the production of steel decline sharply in the next few weeks, the industry would really have run on its momentum for some time. The market had been supported, moreover, by the scarcity of deliveries produced by rail transportation conditions, which became poor before consumers had been able to stock up after the scarcity produced by the steel strike inaugurated only a trifle more than a twelvemonth ago.

#### PRODUCTION

The beginning of curtailment in steel production seems to have begun, but the cases are few, involving only some mills that had been seeking the highest possible prices, and thus had leaner order books than the average mill. Production of steel at the present time is at the highest rate since before the rail strikes began April 1, there having been a continuous increase since July. The probability is that October as a whole will show the heaviest production since March, and the output may even make a new record

entirely, as the operations of the larger mills easily overbalance such curtailment as is in prospect for some of the smaller mills. The March production rate in ingots was about 45,200,000 tons per annum.

#### PIG IRON DECLINING

In the past pig iron prices have always been more sensitive to adverse influences than steel prices, perhaps because pig iron contracts are customarily carried out, while many steel contracts are in the nature of options, and if a mill reduces its open prices it is likely to be called upon to adjust contracts it is carrying on its books. At the present time, therefore, particular attention is being given in trade circles to the pig iron market. Actual values are recognized as being distinctly lower than the prices attained in the advance last August, but a difficulty is that inquiry is so light that actual market prices are but slowly developed, and in most cases there is simply a nominal market price, the real value not having been indicated by actual transactions. At the end of August the valley market was quotable, after the advances, at \$48.50 furnace for bessemer and basic and at \$50 for foundry and malleable. On a small transaction, as noted in last report, the valley foundry iron market became quotable at \$47. Now there are negotiations on basic iron, one or two buyers expecting to do about \$40, and quotations are understood already to have been made at \$44 or \$45. There is a report of one sale at \$46. In the course of a few days enough business will probably have been done to show where the market stands for the time being.

#### NO INQUIRY IN BESSEMER

In bessemer there has been no inquiry and the market has to be quoted at \$48.50 in lieu of any distinct information to the contrary, although no one doubts that on an inquiry for a few thousand tons one could secure a considerably lower price. The one thing that seems clear at the moment is that those who predicted, during recent advances, that pig iron would eventually decline as rapidly as it was then advancing were conservative. Indications now are that it will decline more rapidly.

#### STEEL PRICES

On account of the large amount of business independent steel makers as a whole have on books there is resistance to price declines, but the resistance is not adequate in all cases. In the case of plates 3.25c., which it was thought would prove a sticking point for the market as the delivery premiums disappeared, is now not a minimum but a price "to shoot at," to use an expression common in the trade, the mill usually feeling that the price must be shaded in order to secure an order. A very unattractive specification has been placed at 3.15c., while a fairly desirable order can be placed at 3.10c. and on a lot of several thousand tons of car plates the flat price of 3c. has been made. The Steel Corporation, which has adhered to the Industrial Board price of 2.65c., is receiving the bulk of such business as comes out. In structural shapes the 3.10c. price which was recognized as the minimum of the independents has been shaded to 3c. Bars, however, seem quite firm at 3c. @ 3.25c. Sheets are softening a trifle, but mills are so well sold up that there is little competition.

### The Chemical and Allied Industrial Markets

*New York, October 8, 1920.*

Conditions remaining about the same, there is very little to be noted in any of the markets. Buying interests are still inactive, and as a matter of fact they have had no reason to change their attitude, as the list in general has been well sustained.

The following table will give an idea of a few items that during the past year have remained fairly steady:

	Today	Last Week	Last Month	Last Year
Ammonium sulphate	\$0.07@ \$0.08	\$0.07@ \$0.08	\$0.06@ \$0.07	\$0.05@ \$0.06
Calcium peroxide	1.50@ 1.70	1.50@ 1.70	1.50@ 1.70	1.50@ 1.70
Potassium bichromate	.34@ .36	.34@ .36	.36@ .40	.28@ .30
Potassium chlorate	.18@ .20	.18@ .20	.17@ .20	.19@ .20
Sodium borate	.09@ .11	.09@ .11	.09@ .11	.07@ .08
Sodium hypsulphite	.03@ .04	.03@ .04	.03@ .04	.02@ .03

## NAVAL STORES

Far from advancing the *rosin* market has rather continued on the decline, which has been brought about by the extremely dull condition existing in the South. *Turpentine* is not an exception and the recession can be traced daily by a 1@2c. drop below the previous day's closing price. Current quotations are \$1.30 per gal., which, compared with the price a week ago, represents a 9c. drop. The following table shows the course of *turpentine* and the *rosins* for the past year:

	Today	Last Week	Last Month	Last Year
Turpentine	\$1.30	\$1.39	\$1.55	\$1.70
Rosins:				
H-I	12.90	13.00	14.00@16.25	18.00@18.25
E-I	12.90@13.00	13.00	16.60@16.75	18.50@20.50
WG-WW	13.00	13.00	17.25@17.50	23.50@25.50

## The Baltimore Market

Baltimore, Md., October 6, 1920.

The local market on fertilizer materials continues in a demoralized condition, with a general downward trend of prices. A number of manufacturers report that orders for fall shipment have not come up to their expectations; as a consequence it will be necessary for them to carry over rather heavy stocks of materials until spring. The car situation is reported as greatly improved and we hear few complaints as to shortage of cars. As mentioned above, prices of materials are generally working lower and for that reason the buyers are showing hesitation in purchasing, thinking that the bottom has not yet been reached.

## ACID PHOSPHATE

It is generally believed that the manufacturers have covered fairly well on their requirements for spring, also that the producers of this commodity are well sold up. An occasional export order is noted and spot parcels are changing hands around \$18 per ton, basis 16 per cent bulk, run of pile.

## NITRATE OF SODA

Importers are quoting this commodity at \$3.30@3.40, ex-vessel Atlantic ports for arrival prior to Jan. 1. For arrival after the turn of the year, asking prices are 10@20c. higher. Spot lots of nitrate, however, are being offered around \$3.15 and a sale was reported recently on this market at that price. It is said that at the present rate of exchange it is costing about \$3.70 to deliver nitrate to Atlantic ports at this time, which would indicate that sales at prices mentioned involve rather heavy losses for nitrate merchants.

## SULPHATE OF AMMONIA

Resales of sulphate of ammonia, basis 25 per cent bulk, have been noted on this market at \$4.75. This shows a drop of 75c. per cwt. from the nominal quotation given in last report.

## POTASH

The various grades of potash salts are also showing a downward trend on price. Kainit and manure salts were reported being offered recently as low as \$1.60 per unit of K<sub>2</sub>O. Nominal quotations on this market are slightly higher than this figure. Muriate of potash is quoted nominal at \$2.20 per unit. Nebraska potash is held under contract for forward delivery at the price of \$2 per unit f.o.b. mines. There is no report of any sales for delivery forward from Nov. 1.

## FISH SCRAP

The price of menhaden fish scrap worked as low as \$6 per unit, delivered Baltimore, but has since shown some recovery, as a sale was reported this week at \$6.25 and 10c. delivered Baltimore. The fishing in Chesapeake Bay has been exceptionally good for the last few weeks and as a consequence good tonnages of scrap are being made. It is also reported that the fish are yielding considerably more oil than they did through the summer months.

## General Chemicals

## CURRENT WHOLESALE PRICES IN NEW YORK MARKET

	Carlots	Less Carlots
Acetic anhydride.....lb.		\$0.65 - \$0.75
Acetone.....lb.	\$0.15 - \$0.20	.21 - .22
Acid, acetic, 28 per cent.....cwt.	3.50 - 3.75	4.00 - 4.50
Acetic, 56 per cent.....cwt.	6.50 - 7.50	8.50 - 9.50
Acetic, glacial, 99 1/2 per cent, carboy.....cwt.	14.00 - 16.00	16.25 -
Boric, crystals.....lb.	.15 - .16	.16 - .19
Boric, powder.....lb.	.15 - .16 1/2	.17 - .20
Citric.....lb.	.78 - .80	.82 - .84
Hydrochloric (nominal).....cwt.	2.00 - 2.50	2.75 - 3.00
Hydrofluoric, 52 per cent (nominal).....lb.	.15 - .16	.16 - .18
Lactic, 44 per cent tech.....lb.	.10 - .11 1/2	.12 - .16
Lactic, 22 per cent tech.....lb.	.04 - .05 1/2	.06 - .07
Molybdic, C. P.....lb.	4.00 - 4.50	4.50 - 5.00
Muriatic, 20 deg. (see hydrochloric).....lb.		
Nitric, 40 deg.....lb.	.06 - .07	.07 - .08 1/2
Nitric, 42 deg.....lb.	.07 - .08	.08 - .09 1/2
Oxalic, crystals.....lb.	.45 - .50	.52 - .55
Phosphoric, Ortho, 50 per cent solution.....lb.	.18 - .23	.24 - .25
Picric.....lb.	.28 - .35	.40 - .50
Pyrogallol, resublimed.....lb.	2.30 - 2.55	2.60 - 2.65
Sulphuric, 60 deg., tank cars.....ton	12.00 - 16.00	
Sulphuric, 60 deg., drums.....ton		
Sulphuric, 66 deg., tank cars.....ton	16.00 - 17.00	18.00 - 20.00
Sulphuric, 66 deg., drums.....ton	26.00 - 28.00	
Sulphuric, 66 deg., carboys.....ton		
Sulphuric, fuming, 20 per cent (oleum) tank cars.....ton	27.00 - 30.00	37.00 - 42.00
Sulphuric, fuming, 20 per cent (oleum) drums.....ton	28.00 - 30.00	38.00 - 42.00
Sulphuric, fuming, 20 per cent (oleum) carboys.....ton	32.00 - 35.00	40.00 -
Tannic, U. S. P.....lb.	1.45 - 1.50	1.55 - 1.65
Tannic (tech).....lb.	.60 - .70	.80 - .90
Tartaric, crystals.....lb.		.74 - .77
Tungstic, per lb. of WO.....lb.	1.20 -	1.40
Alcohol, Ethyl (nominal).....gal.	5.50 - 5.75	6.00 - 7.00
Alcohol, Methyl (see methanol).....gal.		
Alcohol, denatured, 188 proof (nominal).....gal.		1.12 - 1.15
Alcohol, denatured, 190 proof (nominal).....gal.		1.05 - 1.10
Alum, ammonia lump.....lb.	.05 - .05 1/2	.05 1/2 - .06
Alum, potash lump.....lb.	.08 - .08 1/2	.09 - .09 1/2
Alum, chrome lump.....lb.		.18 - .19
Aluminum sulphate, commercial.....lb.	.04 -	
Aluminum sulphate, iron free.....lb.	.06 -	
Aqua ammonia, 26 deg., drums (750 lb.).....lb.	.09 1/2 - .10 1/2	.11 - .12
Ammonia, anhydrous, cylinders (100-150 lb.).....lb.	.35 - .35 1/2	.36 - .37
Ammonium carbonate, powder.....lb.	.16 - .16 1/2	.17 - .18
Ammonium chloride, granular (white sal-ammoniac) (nominal).....lb.	.15 1/2 - .16 1/2	.17 - .18
Ammonium chloride, granular (gray sal-ammoniac).....lb.	.13 - .13 1/2	.13 1/2 - .14 1/2
Ammonium nitrate.....lb.	.09 - .10	.11 - .14
Ammonium sulphate.....lb.	.07 - .07 1/2	.08 - .08 1/2
Amylacetate.....gal.		5.00 -
Amylacetate tech.....gal.		4.75 - 5.25
Arsenic, oxide, lumps (white arsenic).....lb.	.15 - .16	.16 - .17
Arsenic, sulphide, powdered (red arsenic).....lb.	.16 - .18	.19 - .23
Barium chloride.....ton	130.00 - 150.00	
Barium dioxide (peroxide).....lb.	.21 - .23	.24 - .25
Barium nitrate.....lb.	.10 - .12	.12 - .13 1/2
Barium sulphate (precip.) (blanc fixe).....lb.	.04 1/2 - .05	.05 1/2 - .06
Bleaching powder (see calcium hypochlorite).....lb.		
Blue vitriol (see copper sulphate).....lb.		
Borax (see sodium borate).....lb.		
Brimstone (see sulphur, roll).....lb.		
Bromine.....lb.	.70 - .90	1.00 - 1.05
Calcium acetate.....cwt.	3.50 - 3.55	
Calcium carbide.....lb.	.04 1/2 - .04 3/4	.04 1/2 - .05 1/2
Calcium chloride, fused, lump.....ton	33.00 - 34.00	35.00 - 45.00
Calcium chloride, granulated.....lb.	.02 - .02 1/2	.03 - .03 1/2
Calcium hypochlorite (bleaching powder).....cwt.	7.25 - 7.50	8.00 - 8.50
Calcium peroxide.....lb.		1.50 - 1.70
Calcium phosphate, monobasic.....lb.		.75 - .80
Calcium sulphate, pure.....lb.		.25 - .30
Carbon bisulphide.....lb.	.08 - .09	.10 - .11
Carbon tetrachloride, drums.....lb.	.14 - .15	.16 - .17
Carbonyl chloride (phosgene).....lb.		1.25 - 1.50
Caustic potash (see potassium hydroxide).....lb.		
Caustic soda (see sodium hydroxide).....lb.		
Chlorine, gas, liquid-cylinders (100 lb.).....lb.	.09 - .09 1/2	.10 - .10 1/2
Chloroform.....lb.	.40 - .43	.44 - .47
Cobalt oxide.....lb.		2.00 - 2.05
Copperas (see iron sulphate).....lb.		
Copper carbonate, green precipitate.....lb.	.27 - .28	.29 - .31
Copper cyanide.....lb.		.65 - .70
Copper sulphate, crystals.....lb.	.08 - .09	.09 - .09 1/2
Cream of tartar (see potassium bitartrate).....lb.		
Epsom salt (see magnesium sulphate).....lb.		
Ethyl Acetate Com. 85%.....gal.	1.10 - 1.30	1.40 -
Ethyl Acetate pure (acetic ether 98% to 100%).....gal.		1.75 -
Formaldehyde, 40 per cent (nominal).....lb.	.48 - .50	
Fusel oil, ref.....gal.		5.25 - 6.00
Fusel oil, crude (nominal).....gal.		
Glauber's salt (see sodium sulphate).....lb.		
Glycerine, C. P. drums extra.....lb.		.26 1/2 - .28 1/2
Iodine, resublimed.....lb.	4.30 - 4.35	4.40 - 4.45
Iron oxide, red.....lb.		.03 - .20
Iron sulphate (copperas).....cwt.	2.00 - 2.25	2.35 - 2.75
Lead acetate, normal.....lb.		.13 1/2 - .16
Lead arsenate (paste).....lb.	.11 - .12	.13 - .17
Lead nitrate, crystals.....lb.		.90 - 1.00
Litharge.....lb.	.14 - .15	.15 1/2 - .16
Lithium carbonate.....lb.		1.50 -
Magnesium carbonate, technical.....lb.	.12 1/2 - .13 1/2	.15 - .16
Magnesium sulphate, U. S. P.....100 lb.	3.50 - 3.90	4.00 - 4.50
Magnesium sulphate, commercial.....100 lb.		3.50 - 3.60
Methanol, 95%.....gal.		3.25 - 3.30
Methanol, pure.....gal.		3.50 - 4.50
Nickel salt, double.....lb.		.14 - .16
Nickel salt, single.....lb.		.13 - .14
Phosgene (see carbonyl chloride).....lb.		
Phosphorus, red.....lb.	.50 - .55	.60 - .65
Phosphorus, yellow.....lb.		.35 - .37
Potassium bichromate.....lb.	.34 - .36	.39 - .40



	Carlota	Less Carlota
Potassium bitartrate (cream of Tartar).....	lb. \$0.52 - \$0.56	\$0.57 - \$0.58
Potassium bromide, granular.....	lb. .50 - .55	.70 - .73
Potassium carbonate, U. S. P.....	lb. .20 - .21	.25 - .25
Potassium carbonate, crude.....	lb. .18 - .18	.19 - .20
Potassium chlorate, crystals.....	lb. .27 - .28	.29 - .33
Potassium hydroxide (caustic potash).....	lb. .17 - .17	.19 - .21
Potassium iodide.....	lb. .75 - .80	.85 - .95
Potassium nitrate.....	lb. .85 - .95	1.00 - 1.05
Potassium permanganate.....	lb. .32 - .36	.35 - .40
Potassium prussiate, red.....	ton \$240.00 - 255.00	
Potassium prussiate, yellow.....		
Potassium sulphate (powdered).....		
Rochelle salts (see sodium potas. tartrate).....		
Sal ammoniac (see ammonium chloride).....		
Salt soda (see sodium carbonate).....		
Salt cake.....	ton 48.00 - 50.00	
Silver cyanide (nominal).....	oz. 1.25 - 1.25	
Silver nitrate (nominal).....	oz. .60 - .62	
Soda ash, light.....	100 lb. 2.80 - 3.00	
Soda ash, dense.....	100 lb. 3.25 - 3.50	
Sodium acetate.....	lb. 10 - 15	
Sodium bicarbonate.....	100 lb. 2.50 - 2.75	
Sodium bichromate.....	lb. .22 - .24	
Sodium bisulphate (nitre cake).....	ton 7.00 - 8.00	
Sodium bisulphate Powdered, U. S. P.....	lb. .08 - .10	
Sodium borate (borax).....	lb. .09 - .10	
Sodium carbonate (sal soda).....	100 lb. 2.00 - 2.10	
Sodium chlorate.....	lb. 11 - 12	
Sodium cyanide, 96-98 per cent.....	lb. .25 - .30	
Sodium fluoride.....	lb. .18 - .18	
Sodium hydroxide (caustic soda).....	100 lb. 5.60 - 5.70	
Sodium hyposulphite.....	lb. 2.50 - 3.25	
Sodium molybdate.....	lb. 3.00 - 3.25	
Sodium nitrate.....	100 lb. 16 - 18	
Sodium nitrite.....	lb. .32 - .35	
Sodium peroxide, powdered.....	lb. .03 - .04	
Sodium phosphate, dibasic.....	lb. .39 - .40	
Sodium potassium tartrate (Rochelle salts).....	lb. .25 - .27	
Sodium prussiate, yellow.....	lb. .01 - .01	
Sodium silicate, solution (40 deg.).....	lb. .02 - .03	
Sodium silicate, solution (60 deg.).....	lb. .02 - .03	
Sodium sulphate, crystals (Glauber's salt).....	cwt. 2.25 - 2.50	
Sodium sulphide, crystal, 60-62 per cent (conc).....	lb. .09 - .10	
Sodium sulphite, crystals.....	lb. .04 - 0.43	
Strontium nitrate, powdered.....	lb. .15 - .18	
Sulphur chloride red.....	lb. .08 - .09	
Sulphur, crude.....	ton 16.00 - 20.00	
Sulphur dioxide, liquid, cylinders.....	lb. .09 - .10	
Sulphur (sublimed), flour.....	100 lb. 3.80 - 4.35	
Sulphur, roll (brimstone).....	100 lb. 3.40 - 3.90	
Tin bichloride (stannous).....	lb. .42 - .44	
Tin oxide.....	lb. .55 - .65	
Zinc carbonate, precipitate.....	lb. .16 - .18	
Zinc chloride, gran.....	lb. .13 - .13	
Zinc cyanide.....	lb. .45 - .49	
Zinc dust.....	lb. .12 - .13	
Zinc oxide, U. S. P.....	lb. .17 - .25	
Zinc sulphate.....	lb. .03 - .03	

## Coal-Tar Products

NOTE—The following prices are for original packages in large quantities:

Alpha-naphthol, crude.....	lb. \$1.30 - \$1.40
Alpha-naphthol, refined.....	lb. 1.50 - 1.65
Alpha-naphthylamine.....	lb. .48 - .52
Aniline oil, drums extra.....	lb. .30 - .33
Aniline salts.....	lb. .34 - .36
Anthracene, 80% in drums (100 lb.).....	lb. .90 - 1.00
Benzaldehyde (f.f.c.).....	lb. 2.00 - 2.10
Benzidine, base.....	lb. 1.35 - 1.40
Benzidine sulphate.....	lb. 1.15 - 1.25
Benzoic acid, U. S. P.....	lb. .85 - .90
Benzoate of soda, U. S. P.....	lb. .80 - .90
Benzene, pure, water-white, in drums (100 gal).....	gal. .35 - .40
Benzene, 90% in drums (100 gal).....	gal. .33 - .38
Benzyl chloride, 95-97%, refined.....	lb. .35 - .40
Benzyl chloride, tech.....	lb. .25 - .35
Beta-naphthol benzoate (nominal).....	lb. 3.50 - 4.00
Beta-naphthol, sublimed (nominal).....	lb. .70 - .75
Beta-naphthol, tech (nominal).....	lb. .65 - .70
Beta-naphthylamine, sublimed.....	lb. 2.25 - 2.40
Cresol, U. S. P., in drums (100 lb.).....	lb. .18 - .19
Ortho-cresol, in drums (100 lb.).....	lb. .23 - .25
Cresylic acid, 97-99%, straw color, in drums.....	gal. 1.10 - 1.15
Cresylic acid, 95-97%, dark, in drums.....	gal. 1.05 - 1.10
Cresylic acid, 50%, first quality, drums.....	gal. .65 - .75
Dichlorobenzene.....	lb. .07 - .10
Diethylaniline.....	lb. 1.50 - 1.60
Dimethylaniline.....	lb. .90 - 1.00
Dinitrobenzene.....	lb. .30 - .37
Dinitrochlorobenzene.....	lb. .32 - .35
Dinitronaphthalene.....	lb. .45 - .55
Dinitrophenol.....	lb. .40 - .45
Dinitrotoluene.....	lb. .38 - .40
Emp oil, 25% tar acids, car lots, in drums.....	gal. .80 - .85
Ethylaniline (nominal).....	lb. 1.90 - 2.05
Hexylamine (nominal).....	lb. 1.25 - 1.30
Hexamethylenediamine.....	lb. .18 - .20
Hexachlorobenzene.....	lb. 2.00 - 2.40
Isomethylaniline.....	lb. .12 - .14
Naphthalene crushed, in bbls. (250 lb.).....	lb. .16 - .17
Naphthalene, flake.....	lb. .16 - .17
Naphthalene, balls.....	lb. .75 - .85
Naphthionic acid, crude.....	lb. .14 - .19
Nitrobenzene.....	lb. .40 - .50
Nitronaphthalene.....	lb. .18 - .25
Nitrotoluene.....	lb. 3.25 - 4.25
Ortho-amidophenol.....	lb. .80 - .85
Ortho-dichlorobenzene.....	lb. .25 - .30
Ortho-nitro-phenol.....	lb. .25 - .30
Ortho-nitro-toluene.....	lb. .35 - .38
Ortho-toluidine.....	lb. 2.50 - 3.00
Para-amidophenol, base.....	lb. 2.50 - 3.00
Para-amidophenol, HCl.....	lb. .08 - .12
Para-dichlorobenzene.....	lb. 1.10 - 1.15
Paranitraniline.....	lb. .10 - .15

Para-nitrotoluene.....	lb. 1.25 - 1.40
Para-phenylenediamine.....	lb. 2.50 - 2.65
Para-toluidine.....	lb. 2.00 - 2.25
Phthalic anhydride.....	lb. .60 - .70
Phenol, U. S. P., drums (dest.), (240 lb.).....	lb. .12 - .20
Pyridine.....	gal. 2.00 - 3.50
Resorcinol, technical.....	lb. 4.25 - 4.50
Resorcinol, pure.....	lb. 6.25 - 6.75
Salicylic acid, tech., in bbls. (110 lb.).....	lb. .45 - .50
Salicylic acid, U. S. P.....	lb. .45 - .50
Salol.....	lb. .90 - 1.00
Solvent naphtha, water-white, in drums, 100 gal.....	gal. .30 - .35
Solvent naphtha, crude, heavy, in drums, 100 gal.....	gal. .20 - .26
Sulphanilic acid, crude.....	lb. .32 - .35
Tolidine.....	lb. 1.70 - 2.50
Toluidine, mixed.....	lb. .45 - .55
Toluene, in tank cars.....	gal. .35 - .40
Toluene, in drums.....	gal. .38 - .40
Xylenes, drums, 100 gal.....	lb. .50 - .65
Xylene, pure, in drums.....	gal. .47 - .50
Xylene, pure, in tank cars.....	gal. .45 - .50
Xylene, commercial, in drums, 100 gal.....	gal. .32 - .35
Xylene, commercial, in tank cars.....	gal. .30 - .35

## Waxes

Prices based on original packages in large quantities.

Beeswax, refined, dark.....	lb. \$0.33 - \$0.58
Beeswax, refined, light.....	lb. .34 - .37
Beeswax, white pure.....	lb. .60 - .65
Carnauba, No. 1, (nominal).....	lb. .90 - .95
Carnauba, No. 2, regular (nominal).....	lb. .85 - .86
Carnauba, No. 3, North Country.....	lb. .35 - .36
Japan.....	lb. .18 - .20
Montan, crude.....	lb. .14 - .15
Paraffine waxes, crude match wax (white) 105-110 m.p.....	lb. .09 - .09
Paraffine waxes, crude, scale 124-126 m.p.....	lb. .09 - .10
Paraffine waxes, refined, 118-120 m.p.....	lb. .11 - .11
Paraffine waxes, refined, 125 m.p.....	lb. .12 - .13
Paraffine waxes, refined, 128-130 m.p.....	lb. .13 - .15
Paraffine waxes, refined, 133-135 m.p.....	lb. .16 - .17
Paraffine waxes, refined, 135-137 m.p.....	lb. .17 - .18
Stearic acid, single pressed.....	lb. .20 - .21
Stearic acid, double pressed.....	lb. .22 - .23
Stearic acid, triple pressed.....	lb. .24 - .25

NOTE—Paraffine waxes very scarce.

## Flotation Oils

All prices are f.o.b. New York, unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Pine oil, steam dist., sp. gr. 0.930-0.940.....	gal. \$2.15
Pine oil, pure, dest. dist.....	gal. 1.80
Pine tar oil, ref., sp. gr. 1.025-1.035.....	gal. .48
Pine tar oil, crude, sp. gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.....	gal. .35
Pine tar oil, double ref., sp. gr. 0.965-0.990.....	gal. .85
Pine tar, ref., thin, sp. gr. 1.080-1.060.....	gal. .36
Turpentine, crude, sp. gr. 0.900-0.970.....	gal. 1.75
Hardwood oil, f.o.b. Mich., sp. gr. 0.960-0.990.....	gal. .95
Pinewood creosote, ref.....	gal. .52

## Naval Stores

The following prices are f.o.b., New York, for carload lots.

Rosin B-D, bbl.....	280 lb. \$13.00
Rosin E-F.....	280 lb. 13.10
Rosin K-N.....	280 lb. 13.15
Rosin W. G. W. W.....	280 lb. 13.25
Wood rosin, bbl.....	280 lb. 12.50
Spirits of turpentine.....	gal. 1.30
Wood turpentine, steam dist.....	gal. .
Wood turpentine, dest. dist.....	gal. .
Pine tar pitch, bbl.....	200 lb. 8.50
Tar, kiln burned, bbl. (500 lb.).....	bbl. 14.50 - 15.00
Retort tar, bbl.....	500 lb. 15.00 - 15.50
Rosin oil, first run.....	gal. .72
Rosin oil, second run.....	gal. .75
Rosin oil, third run.....	gal. .92

## Solvents

73-76 deg., steel bbls. (85 lb.).....	gal. \$0.40
70-72 deg., steel bbls. (85 lb.).....	gal. .38
68-70 deg., steel bbls. (85 lb.).....	gal. .37
V. M. and P. naphtha, steel bbls. (85 lb.).....	gal. .29

## Crude Rubber

Para-Upriver fine.....	lb. \$0.26 - \$0.26
Upriver coarse.....	lb. .17 - .18
Upriver caucho ball.....	lb. .17 - .18
Plantation—First latex crepe.....	lb. .25
Ribbed smoked sheets.....	lb. .24
Brown crepe, thin, clean.....	lb. .22
Amber crepe No. 1.....	lb. .22

## Oils

## VEGETABLE

The following prices are f.o.b., New York for carload lots.

Castor oil, No. 3, in bbls.....	lb. \$0.16 - \$0.18
Castor oil, AA, in bbls.....	lb. .17 - .17
China wood oil, in bbls. (f.o.b. Pac coast).....	lb. .17 - .18
Cocanut oil, Ceylon grade, in bbls.....	lb. .15 - .16
Cocanut oil, Cochon grade, in bbls (nominal).....	lb. .16 - .17
Corn oil, crude, in bbls.....	lb. .12 - .13
Cottonseed oil, crude (f.o.b. mill).....	lb. .10 - .11
Cottonseed oil, summer yellow.....	lb. .14 - .15
Cottonseed oil, winter yellow.....	lb. .
Linseed oil, raw, car lots (domestic).....	gal. 1.22 - .
Linseed oil, raw, tank cars (domestic).....	gal. 1.16 - .
Linseed oil, boiled, car lots (domestic).....	gal. 1.24 - .

Olive oil, commercial.....	gal.	3.00	—	3.50
Palm, Lagos.....	lb.	.10	—	—
Palm, bright red.....	lb.	—	—	—
Palm, Niger.....	lb.	.09	—	.10
Peanut oil, crude, tank cars (f.o.b. mill).....	lb.	.10	—	.12
Peanut oil, refined, in bbls.....	lb.	.17	—	.18
Rapeseed oil, refined in bbls.....	gal.	1.30	—	1.45
Rapeseed oil, blown, in bbls.....	gal.	1.60	—	1.70
Soya bean oil (Manchurian), in bbls N. Y.....	lb.	.14	—	.14
Soya bean oil, tank cars, f.o.b., Pacific coast.....	lb.	.10	—	.11

## FISH

Winter pressed Menhaden.....	gal.	\$0.85	—	\$0.90
Yellow bleached Menhaden.....	gal.	.87	—	.90
White bleached Menhaden.....	gal.	.90	—	.92
Blown Menhaden.....	gal.	1.05	—	—

## Miscellaneous Materials

All f. o. b. New York Unless Otherwise Stated

Barytes, ground, white, f.o.b. Kings Creek, S. C.	net ton	\$22.00	—	\$25.00
Barytes, ground, off color, f.o.b. Kings Creek	net ton	18.00	—	20.00
Barytes, crude, 88% to 94% ba., Kings Creek	net ton	8.00	—	10.00
Barytes, ground, white, f.o.b. Cartersville, Ga.	net ton	23.00	—	25.00
Barytes, ground, off-color, f.o.b. Cartersville	net ton	16.00	—	19.00
Barytes, crude, 88% to 94% ba., Cartersville	net ton	12.00	—	—
Barytes, floated, f.o.b. St. Louis	net ton	26.50	—	28.00
Barytes, crude, min. 98% ba., Missouri	net ton	11.00	—	11.25
Blanc fixe, dry.....	lb.	.05	—	.06
Blanc fixe, pulp.....	net ton	60.00	—	80.00
Casein.....	lb.	.15	—	.18
Chalk, domestic, extra light.....	lb.	.05	—	.06
Chalk, domestic, light.....	lb.	.04	—	.05
Chalk, domestic, heavy.....	lb.	.04	—	.05
Chalk, English, extra light.....	lb.	.05	—	.07
Chalk, English, light.....	lb.	.05	—	.06
Chalk, English, dense.....	lb.	.04	—	.05
China clay, (Kaolin) crude, f.o.b. mines, Georgia	net ton	9.00	—	12.00
China clay (Kaolin) washed, f.o.b. Georgia	net ton	12.00	—	15.00
China clay (Kaolin) powdered, f.o.b. Georgia	net ton	18.00	—	22.00
China clay (Kaolin) crude f.o.b. Virginia points	net ton	8.00	—	12.00
China clay (Kaolin) ground, f.o.b. Virginia points	net ton	15.00	—	40.00
China clay (Kaolin), imported, lump.....	net ton	25.00	—	35.00
China clay (Kaolin), imported, powdered.....	net ton	30.00	—	60.00
Feldspar, crude, f.o.b. Maryland and North Carolina points	gross ton	7.50	—	8.00
Feldspar, crude, f.o.b. Maine	net ton	7.50	—	10.00
Feldspar, ground, f.o.b. Maine	net ton	21.00	—	23.00
Feldspar, ground, f.o.b. North Carolina	net ton	17.00	—	21.00
Feldspar, ground, f.o.b. N. Y. State	net ton	17.00	—	21.00
Feldspar, ground, f.o.b. Baltimore	net ton	30.00	—	35.00
Fuller's earth, granular, f.o.b. Fla.	net ton	25.00	—	—
Fuller's earth, powdered, f.o.b. Fla.	net ton	18.00	—	—
Fuller's earth, imported, powdered.....	net ton	35.00	—	40.00
Graphite (dust polish grade 30%) Ashland, Ala.	lb.	—	—	.01
Graphite (dust facing grade 50%) Ashland, Ala.	lb.	—	—	.02
Graphite, crucible, 80% carbon Ashland, Ala.	lb.	—	—	.05
Graphite, crucible, 90% carbon Ashland, Ala.	lb.	—	—	.10
Graphite, crucible, 85% carbon	lb.	—	—	.08
Graphite, crucible, 88% carbon	lb.	—	—	.09
Graphite, crucible, 90% carbon	lb.	—	—	.10
Pumice stone, imported, lump.....	lb.	.04	—	.50
Pumice stone, domestic, lump.....	lb.	.06	—	—
Pumice stone, ground.....	lb.	.04	—	.07
Quartz (acid tower) fist to head, f.o.b. Baltimore	net ton	—	—	10.00
Quartz (acid tower) 1 1/2 in., f.o.b. Baltimore	net ton	—	—	14.00
Quartz (acid tower) rice, f.o.b. Baltimore	net ton	—	—	17.00
Quartz, lump, f.o.b. North Carolina	net ton	5.00	—	7.50
Shellac, orange fine.....	lb.	1.15	—	1.30
Shellac, orange superfine.....	lb.	1.10	—	1.20
Shellac, A. C. garnet.....	lb.	.90	—	.95
Shellac, T. N.....	lb.	.85	—	.95
Soapstone.....	ton	15.00	—	25.00
Talc, paper-making grades, f.o.b. Vermont	ton	12.00	—	22.00
Talc, roofing grades, f.o.b. Vermont	ton	9.50	—	15.00
Talc, rubber grades, f.o.b. Vermont	ton	12.00	—	18.00
Talc, powdered, Southern, f.o.b. cars	ton	12.00	—	15.00
Talc, imported.....	ton	60.00	—	70.00
Talc, California Talcum Powder grade	ton	20.00	—	35.00

## Refractories

Bauxite brick, 56% Al, f.o.b. Pittsburgh	1,000	—	160
Chrome brick, f.o.b. Eastern shipping points	net ton	—	100-110
Chrome cement, 40-45% Cr <sub>2</sub> O <sub>3</sub>	net ton	—	55-60
Chrome cement, 40-45% Cr <sub>2</sub> O <sub>3</sub> , sacks, in car lots, f.o.b. Eastern shipping points	net ton	—	60-65
Fire clay brick, 1st quality, 9-in. shapes, f.o.b. Pennsylvania, Ohio and Kentucky works	1,000	—	55-60
Fire clay brick, 2nd quality, 9-in. shapes, f.o.b. Pennsylvania, Ohio and Kentucky works	1,000	—	45-50
Magnesite brick, 9-in. straight	net ton	—	110
Magnesite brick, 9-in. arches, wedges and keys	net ton	—	121
Magnesite brick, soaps and splits	net ton	—	134
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	—	65-70
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	—	56-61
Silica brick, 9-in. sizes, f.o.b. Mt. Union, Pa.	1,000	—	55-60

## Ferro-Alloys

All f.o.b. Works

Ferro-carbon-titanium, 15-18%, f.o.b. Niagara Falls, N. Y.	net ton	\$200.00	—	\$250.00
Ferro-chrome, per lb. of Cr. contained, 6-8% carbon, carlots	lb.	.18	—	.19
Ferro-chrome, per lb. of Cr. contained, 4-6% carbon, carlots	lb.	.20	—	.21
Ferro-manganese, 76-80% Mn, domestic	gross ton	170.00	—	180.00
Ferro-manganese, 76-80% Mn, English	gross ton	170.00	—	175.00
Spiegelisen, 18-22% Mn	gross ton	82.50	—	85.00
Ferro-molybdenum, 50-60% Mo, per lb. of Mo.	lb.	2.00	—	2.50
Ferro-silicon, 10-15%	gross ton	60.00	—	65.00
Ferro-silicon, 50%	gross ton	80.00	—	90.00
Ferro-silicon, 75%	gross ton	150.00	—	160.00
Ferro-tungsten, 70-80%, per lb. of contained W.	lb.	.90	—	1.05
Ferro-uranium, 35-50% of U, per lb. of U content	lb.	7.00	—	—
Ferro-vanadium, 30-40% per lb. of contained V.	lb.	6.50	—	8.50

## Ores and Semi-finished Products

All f.o.b. Mines, Unless Otherwise Stated

Bauxite, 52% Al. content, less than 2% Fe <sub>2</sub> O <sub>3</sub> , up to 201% silica, not more than H <sub>4</sub> % moisture	gross ton	\$10.00	—	\$11.00
Chrome ore, Calif. concentrates, 50% min. Cr <sub>2</sub> O <sub>3</sub>	unit	.70	—	.75
Chrome ore, 50%, max., Cr <sub>2</sub> O <sub>3</sub> , f.o.b. Atlantic Seaboard	unit	.75	—	.85
*Coke, foundry, f.o.b. ovens	net ton	—	—	18.00
*Coke, furnace, f.o.b. ovens	net ton	16.50	—	17.00
*Coke, petroleum, refinery, Atlantic Seaboard	net ton	24.00	—	—
Fluorspar, lump, f.o.b. Tonuco, New Mexico	net ton	17.50	—	—
Fluor spar, standard, domestic washed gravel	net ton	80.00	—	100.00
Kentucky and Illinois mines	lb.	.01	—	85.02
Ilmenite, 52% TiO <sub>2</sub> , per lb. ore	unit	.60	—	.70
Manganese Ore, 50% Mn, c.i.f. Atlantic seaport	gross ton	80.00	—	100.00
Manganese ore, chemical (MnO <sub>2</sub> )	lb.	.70	—	.75
Molybdenite, 85% MoS <sub>2</sub> , per lb. of MoS <sub>2</sub> , N. Y.	unit	.42	—	—
Monazite, per unit of ThO <sub>2</sub>	unit	.12	—	—
Pyrites, Spanish, fines, c.i.f. Atlantic seaport	unit	.16	—	—
Pyrites, Spanish, furnace size, c.i.f. Atlantic seaport	unit	.12	—	.14
Pyrites, domestic, fines	unit	.12	—	.14
Rutile, 95% TiO <sub>2</sub> per lb. ore	lb.	.15	—	—
Tungsten, Scheelite, 60% WO <sub>3</sub> and over, per unit of WO <sub>3</sub>	unit	6.00	—	—
Tungsten, Wolframite, 60% WO <sub>3</sub> and over, per unit of WO <sub>3</sub> , N. Y. C.	unit	4.50	—	5.00
Uranium Ore (Carnotite) per lb. of U <sub>3</sub> O <sub>8</sub>	lb.	2.75	—	3.00
Uranium oxide, 96% per lb. contained U <sub>3</sub> O <sub>8</sub>	lb.	2.75	—	3.00
Vanadium pentoxide, 99%	lb.	12.00	—	14.00
Vanadium Ore, per lb. of V <sub>2</sub> O <sub>5</sub> contained	lb.	1.25	—	—
Zircon, washed, iron free	lb.	.05	—	—

\*Nominal

## Non-Ferrous Metals

New York Markets

	Cents per Lb.
Copper, electrolytic.....	18.50
Aluminum, 98 to 99 per cent.....	34.80
Antimony, wholesale lots, Chinese and Japanese	7.00
Nickel, ordinary (Ingot).....	43.00
Nickel, electrolytic.....	45.00
Tin, 5-ton lots.....	44.50
Lead, New York, spot.....	8.50
Lead, E. St. Louis, spot.....	8.00
Zinc, spot, New York.....	8.50
Zinc, spot, E. St. Louis.....	7.70@8.05

## OTHER METALS

Silver (Commercial).....	oz.	\$0.91 1/2
Cadmium.....	lb.	1.40@1.50
Bismuth (500 lb. lots).....	lb.	2.55
Cobalt.....	lb.	6.00
Magnesium (f.o.b. Niagara Falls).....	lb.	1.75
Platinum.....	oz.	110.00
Iridium.....	oz.	350.00@400.00
Palladium.....	oz.	100.00
Mercury.....	75 lb.	72.00

## FINISHED METAL PRODUCTS

Warehouse Price  
Cents per Lb.

Copper sheets, hot rolled.....	33.50
Copper bottoms.....	38.00
Copper rods.....	38.00@40.00
High brass wire and sheets.....	30.25
High brass rods.....	27.00
Low brass wire and sheets.....	28.50
Low brass rods.....	29.00
Brazed brass tubing.....	38.25
Brazed bronze tubing.....	41.75
Seamless copper tubing.....	34.00
Seamless high brass tubing.....	33.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy and crucible.....	15.00	17.00	14.00	15.00
Copper, heavy and wire.....	14.00	16.00	13.50	14.50
Copper, light and bottoms.....	12.50	14.00	12.00	13.00
Lead, heavy.....	7.00	4.75	7.00	7.00
Lead, tea.....	5.00	3.75	4.00	6.00
Brass, heavy.....	9.50	10.50	10.00	14.50
Brass, light.....	7.00	7.50	7.00	8.00
No. 1 yellow brass turnings.....	8.50	10.00	7.50	8.00
Zinc.....	5.00	5.00	4.50	5.50

## Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by 1/2 in. and larger, and plates 1 in. and heavier, from jobbers' warehouses in the cities named:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes.....	\$4.58	\$4.47	\$3.47	\$5.00	\$3.37	\$4.08
Soft steel bars.....	4.73	4.62	3.37	4.50	3.27	3.98
Soft steel bar shapes	4.73	4.62	3.37	4.50	3.27	3.98
Soft steel bands.....	6.43	6.32	4.07	6.25	—	—
Plat.s. 1 to 1 in. thick	4.78	4.67	3.67	4.50	3.57	4.28



# Industrial

Financial, Construction and Manufacturers' News

## Construction and Operation

### Connecticut

**ANSONIA**—The Amer. Brass Co., 58 Liberty St., will soon award the contract for the construction of a 1-story, 340x400 ft. addition to its factory. Estimated cost, \$700,000. Noted Sept. 22.

**NEW BRITAIN**—The Vulcan Iron Wks., 63 John St., has awarded the contract for the construction of a 1-story, 90x100-ft. foundry, to John Kung Co., 50 Green St. Estimated cost, between \$45,000 and \$50,000.

**NEW HAVEN**—The Connecticut Adamant Plaster Co., River St., plans to build a 2-story plaster plant. Estimated cost, \$150,000.

### District of Columbia

**WASHINGTON**—The Bureau of Yards & Docks, Navy Dept., will receive bids until Oct. 15 for the construction of a 3-story, 60x200-ft. office and laboratory, 2-story, 82x300-ft. machine and testing shop, 1-story, 60x100-ft. foundry, etc. at the Naval Experimental and Research Laboratory at Bellevue.

### Florida

**WEST PALM BEACH** (Palm Beach P. O.)—The State Bd. of Health, Jacksonville, will receive bids until Oct. 22 for the construction of a branch laboratory building here.

### Illinois

**CHICAGO**—The Kroeschell Bros. Ice Machine Co., 460 West Erie St., plans to build a new plant, including a machine shop, etc., on the south side of Diversey Ave., west of the St. Paul R.R. tracks.

### Indiana

**INDIANAPOLIS**—The Link Belt Co., South Addison St. and the Big Four R.R., has awarded the contract for the construction of a 1-story factory on Belmont Ave. to W. P. Jungclaue, 825 Mass. Ave.

### Iowa

**FORT DODGE**—The Bd. Educ. will receive bids until Oct. 27 for the construction of a 3-story, 190x260-ft. high school. A chemical laboratory will be installed in same. Estimated cost, \$650,000. P. E. Gustafson, secy. W. B. Ittner, Bd. Educ. Bldg., St. Louis, Mo., archt.

### Maryland

**BALTIMORE**—James J. Lacy Co., Philpot and Wells Sts., has awarded the contract for the construction of a foundry addition, to R. B. Mason, 308 West Madison St. Estimated cost, \$14,000.

**BALTIMORE**—The Natl. Bituminous Enamel & Paint Corp., Keyser Bldg., has awarded the contract for the construction of a paint and enamel plant, to the Price Constr. Co., Maryland Trust Bldg. Estimated cost, \$23,000.

**CUMBERLAND**—The Amer. Cellulose & Chemical Mfg. Co. plans to build an addition to its plant.

### Massachusetts

**WORCESTER**—The Worcester Fdry. Co. Inc., 180 Prescott St., will build a 1-story, 60x150-ft. addition to its foundry on Prescott St. Estimated cost, \$30,000. Work will be done by day labor.

### Minnesota

**FRIDLEY**—The Walsh Creosoting Co., St. Louis, Mo., plans to build a creosoting plant here. Estimated cost, \$200,000.

### Missouri

**CLAYTON**—The city rejected all bids for the construction of sewers in sewer districts 1, 2 and 3. A septic tank will be installed in each. Work will be readvertised.

### Nebraska

**DANNEBROG**—The Bd. Educ. is having plans prepared for the construction of a 2-story, 53x90-ft. school. A septic tank will be installed in same. Cost, between \$115,000 and \$120,000. W. Mape, Sheridan Bldg., Kansas City, Mo., archt.

**MINATARE**—The Great Western Sugar Co., Sugar Bldg., Denver, Col., will build a sugar factory to have a capacity of 1,200 tons of beets per day. Estimated cost, \$2,000,000. Work will be done by day labor. Noted Aug. 18.

### New York

**BROOKLYN**—The Grand Corrugated Paper Co., 30 Crosby St., will soon award the contract for altering a factory on 32nd St. Estimated cost, \$50,000. P. Tillion & Son, 103 Park Ave., New York City, archt. and engr.

**FORT NIAGARA**—The Construction Dept., War Dept., Wash., D. C., plans to construct a filtration plant here. Estimated cost, \$25,000.

### North Carolina

**GASTONIA**—The city has awarded the contract for the construction of a sewage disposal plant, to B. W. Harris, Durham. Estimated cost, \$60,000.

### North Dakota

**MARMARTH**—The Bd. Educ. has awarded the contract for the construction of a 2-story, 61x91-ft. high school, to the Colewell-Long Co., 354 Plymouth Bldg., Minneapolis, Minn. A chemical laboratory will be installed in same. Estimated cost, about \$125,000. Noted Sept. 15.

### Ohio

**CLEVELAND HEIGHTS** (Cleveland P. O.)—The Bd. Educ., Lee Rd., will receive bids until Oct. 20 for furnishing school building equipment, including chemical laboratory equipment, etc. Estimated cost, \$100,000. F. C. Warner, Hippodrome Annex Bldg., Cleveland, archt.

**COLUMBUS**—The Amer. Rolling Mill Co., Toledo & Ohio Central R.R., Parsons Ave., Columbus, O., has awarded the contract for the construction of an addition to its present plant, to Dwight P. Robinson, 125 East 46th St., New York City. Estimated cost, \$300,000.

### Pennsylvania

**PHILADELPHIA**—Dill & Collins, Richmond and Tioga Sts., has awarded the contract for the construction of a 3-story, 28 x58-ft. filter and pulp mill, on Manayunk St., to W. Steele & Sons Co., 16th and Arch Sts.

**UNIONTOWN**—The Uniontown Hospital will receive bids until Nov. 1 for the construction of a 3-story, 60x170-ft. hospital. A chemical laboratory will be installed in same. H. W. Altman, archt.

### Tennessee

**MEMPHIS**—The Dixie Rubber Co. has awarded the contract for the construction of a 1-story, 75x290-ft. building, to the Hydraulic Steelcraft Co., Hydraulic Ave., Cleveland, O.

### Texas

**DALLAS**—The Trinity Paper Mills, 401 Marvin Bldg., and G. A. Beeman, Comanche, plans to construct three mills in Texas and will be in the market for equipment.

### Wisconsin

**FOND DU LAC**—J. B. Fellrath, 180 North Main St., will build a 1- and 2-story, 70x120-ft. concrete block manufacturing plant on Brook Ave. Work will be done by day labor.

**HORICON**—The Van Brunt Mfg. Co. will build a 1-story, 80x200-ft. foundry addition and a 40x80-ft. dry kiln. Work will be done by day labor.

**MILWAUKEE**—Backer & Pfaller, archts., 216 West Water St., will soon award the

contract for the construction of a 1-story, 90x150-ft. factory on State St., for the manufacture of cement blocks, for the Shope Brick Co., 216 West Water St.

**MILWAUKEE**—The Modern Steel Casting Co., 1400 33rd St., plans to build a 1-story, 80x500-ft. or a 70x350-ft. foundry on 33rd St.

### Quebec

**MONTREAL**—The governors of McGill University will have plans prepared for the construction of a biological laboratory, a modern pathological institute and a psychopathic hospital. Estimated cost, \$1,250,000.

## Coming Meetings and Events

**AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE** will hold its 1920 meeting Dec. 27, 1920, to Jan. 1, 1921, at Chicago, Ill.

**AMERICAN CERAMIC SOCIETY** will hold its annual meeting the week of Feb. 21, 1921, at Columbus, Ohio, with headquarters at the Deschler Hotel.

**AMERICAN ENGINEERING COUNCIL** of the Federated American Engineering Societies will hold a meeting Nov. 18 and 19, 1920, in Washington, D. C. Headquarters will be at the New Willard Hotel.

**AMERICAN MINING CONGRESS** will hold its next convention in Denver Nov. 15 to 19.

**AMERICAN PHYSICAL SOCIETY** will hold a meeting Nov. 27 at the Case School of Applied Science, Cleveland, and the annual meeting, beginning Dec. 28, at Chicago, the latter being the occasion of the special quadrennial meeting of the American Association for the Advancement of Science and the Affiliated Societies.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS'** 1920 annual meeting will be held in the Engineering Societies' Building from Dec. 7 to 10 inclusive.

**CANADIAN INSTITUTE OF MINING AND METALLURGY** will hold its second annual Western meeting in Winnipeg, Man., on Oct. 25, 26 and 27. Headquarters will be at the Hotel Fort Garry.

**ENGINEERING COUNCIL** will hold its next meeting in Chicago, Thursday, Oct. 21.

**SOCIETY OF INDUSTRIAL ENGINEERS** will hold its fall national convention at Carnegie Music Hall, Pittsburgh, Pa., Nov. 10, 11 and 12.

## Industrial Notes

**THE C. & G. COOPER Co.**, of Mt. Vernon, O., at the regular June directors' meeting, elected B. E. Williams president of the company to succeed D. B. Kirk, deceased; F. H. Thomas was elected vice-president to succeed Mr. Williams and N. L. Daney was elected treasurer to succeed Mr. Thomas. The Chapman Engineering Co., the Chapman-Stein Furnace Co., and the Marion Die, Tool & Machine Co., with its well-equipped plant at Marion, O., are subsidiaries of the Cooper company. The complete service of the combined companies therefore now includes not only the Cooper gas engines and Cooper Corliss engines, it covers also Chapman gas producers and Chapman-Stein furnaces. This complete combustion engineering service enters practically every line of industry which utilizes gas for power or for industrial heat.

**THE OXWELD ACETYLENE Co.**, New York City, has established Pacific Coast sales and distributing headquarters at San Francisco, with offices at 1077 Mission St. This company also announces that the export department, which was formerly located at the company's factory in Newark, N. J., has been removed to the Carbide and Carbon Bldg., 30 East 42d St., New York. The department has been reorganized and is now under the direction of R. G. Noble, who will co-operate with the general sales department of the company.

**D. M. LIDDELL** announces the removal of his offices to 2 Rector St., New York City.

**DICKS-DAVID & Co.**, of New York, and DICKS, DAVID & HELLER, of Chicago, manufacturers of dyes and intermediates, have consolidated into one firm under the name of the former.

**DR. ROBERT P. FISCHER**, consulting chemist, of Philadelphia, has removed his business office to the Foster Bldg., 280 Madison Ave. (corner 40th St.), New York City. He is specializing on investigations of markets and sources of supply for chemical, pharmaceutical and biological products

and the preparation of scientific and commercial literature along chemical, pharmaceutical and medical lines. Dr. Fischelis will continue as a member of the faculty of the Philadelphia College of Pharmacy and as director of the technical department of the Matos Advertising Co., of Philadelphia. He has also been retained by the National Research Council to assist in securing the support of the chemical industries in the matter of publishing an American volume of critical tables of physical and chemical constants.

OLIVER CONTINUOUS FILTER Co., manufacturer of the Oliver Continuous Filter, dry vacuum pumps, air compressors, centrifugal pumps, etc., has appointed J. F. Mitchell-Roberts as its special representative in England and Europe. Offices have been established at No. 2 Broad St. Place, London, E. C. 2, England. In connection with its offices at 33 West 42d St., New York, and 503 Market St., San Francisco, Cal., this company maintains laboratories for investigation of filtration problems and similar arrangements will be made at its new London office.

WHITING FOUNDRY EQUIPMENT Co., of Harvey, Ill., and the AMERICAN FOUNDRY EQUIPMENT Co., of New York, consolidated to form the Whiting Corporation, capitalized at \$5,000,000. J. H. Whiting becomes chairman of the board and V. E. Minich president of the company. The Whiting plant at Harvey will retain the manufacture of cranes, cupolas, hoists, mills, core ovens and all other items of the established Whiting line, together with sand-blast equipment and dust arresters. Sand-cutting machines and steel castings will comprise the bulk of the work at the new American plant at 2935 West 47th St., Chicago, under the direction of E. A. Rich, Jr. Molding machines, jolts, slabs, specialties and pattern-mounting materials will continue to be manufactured at the York, Pa., plant of the American company in charge of R. S. Buch.

THE MIDWEST ENGINE Co. has sent its exhibit which was at the National Exposition of Chemical Industries to the office of Charles F. Ames & Co., Ltd., 90 West St., New York.

FRANK LABORATORIES FOR CHEMICAL INDUSTRY, San Francisco, announces the beginning of work on a new chemical factory in Oakland, Cal., on Oct. 1, for the production of organic chemicals from crude oil tars and shale oil.

CHARLES PIEZ, president of the Link-Belt Co. and former director general of the Emergency Fleet Corp., has written a report on the steel strike. Copies of the article can be secured by applying to the executive offices of the Link-Belt Co., 910 South Michigan Ave., Chicago, Ill.

WILEY & Co. announces the removal of its laboratory and offices to the northwest corner of Calvert & Read Sts., Baltimore, Maryland.

INDEPENDENT CHEMICAL Co., Inc., of Hartford, Conn., has recently been organized and incorporated with a capital stock of \$25,000, to engage in manufacturing chemicals, etc. Further information can be secured from M. A. Flerberg, 16 Westland St., Hartford, Conn.

THE PETROLEUM RECTIFYING Co. OF CALIFORNIA announces the engagement of the services of Sanderson & Porter, consulting engineers, to supervise research work and the development of apparatus and equipment for the dehydrating of petroleum emulsions by the electric process. The basic Cottrell patents controlled by the company have recently been adjudicated by the United States Supreme Court. It is now proposed to further develop the apparatus with the view of increasing the capacity and efficiency.

DWIGHT P. ROBINSON & Co., Inc. (with which Westinghouse, Church, Kerr & Co., Inc., has recently consolidated), engineer and constructor, of New York, has established a new branch office in Youngstown, O., in the Home Savings & Loan Bldg., in charge of C. I. Crippen. The company recently moved its Cleveland office from the Leader-News Bldg. to the Citizens' Bldg., and H. P. Clawson, who was for several years a member of the Chicago staff, has been transferred to Cleveland to take charge of this office. The company now maintains branch offices in Pittsburgh, Youngstown, Cleveland, Chicago, Dallas and Los Angeles, and Sao Paulo, Brazil.

STANDARDIZATION COMMITTEE OF THE NATIONAL ASSOCIATION OF PURCHASING AGENTS considered four problems at its meeting at Chicago Oct. 9. They were: Standardization of catalogs; standardization of invoices; pricing on a decimal basis; standardizing shafting uses.

## Manufacturers' Catalogs

QUIGLEY FURNACE SPECIALTIES Co., New York, is distributing a new booklet on "Hytempite in the Gas Plant." This 16-page booklet contains illustrations showing how Hytempite serves, and how the life of brick work is increased by proper bonding of refractories, also Hytempite in the gas plant, laying firebrick and tile, in gas generators, flue linings and valves, for patches and repair work, the spraying of Hytempite for filling cracks, coating walls and other brickwork, sealing coke oven jamb joints, gas producer linings and for industrial gas fired furnaces.

THE MERRILL Co., San Francisco, Cal., has issued a booklet on the Nordstrom Lubricated Plug Valve.

MAURICE A. KNIGHT, East Akron, O., has issued a folder which, although it is not a full catalog or a complete list of what he manufactures, is a guide to the possibilities of design of acid-proof chemical stoneware apparatus, which can be made in any shape or design mechanically possible. In this folder are various explanatory and instructive articles on the subject of chemical stoneware, its uses and limitations.

UEHLING INSTRUMENT Co., 71 Broadway, New York, has just issued Bull. No. 111 describing Style U Uehling CO<sub>2</sub> equipment. This is a new design built in single and multiple forms, the latter serving any number of steam boilers simultaneously up to a total of six. The purpose of this equipment is to save fuel by burning it with the proper air supply. Among the notable features of the new machine are speedy action, resulting from a new form of aspirator, absence of chemical solutions, greater simplicity and the unique plan of providing an auxiliary boiler front CO<sub>2</sub> indicator, which guides the fireman, while the CO<sub>2</sub> recorder, installed in the chief engineer's or superintendent's office, makes a continuous (not intermittent) record, showing all changes in boiler adjustments that are conducive to either waste or economy.

THE WESTERN REINFORCED CONCRETE PIPE Co., Los Angeles, Cal., calls attention to a catalog on Reinforced Concrete Pipe. In this book is pointed out the unique adaptability of reinforced concrete pipe for sewers, storm drains, culverts, pressure lines and irrigation systems. Many interesting illustrations are given together with descriptions and letters from users.

PYROELECTRIC INSTRUMENT Co., Trenton, N. J., has issued Bull. 14, which contains an article on hydrogen ion determinations, together with descriptive apparatus and notes on technical applications of the methods.

ALBERGER CHEMICAL MACHINERY Co., Grand Central Palace, New York City, has just published several booklets. One folder describes Agitator Drives for stirring, mixing, agitating, dissolving and digesting, while Bull. 26, also on Alberger Agitator Drives, describes the six sizes of bevel gear drives and six sizes of worm gear drives, together with several designs of stirrers, which are illustrated. Bull. 28, on Chemical Apparatus, illustrates and describes autoclaves, nitrotrators, heat interchangers, sulphonators, mixing kettles and digestors.

GRISCOM-RUSSELL Co., New York, has issued Bull. 260, on the Reilly Water Heater. Many interesting types of this multicoil heater are illustrated and described.

THE SMITH GAS ENGINEERING Co., Dayton, O., is distributing Bull. 16, on the Smith Type "G" Gas Producer, which produces cold clean producer gas for power and industrial heating. Typical gas analyses are given, together with the design of the producer, the process of gas production, the rating, the practical uses for Smith cold clean producer gas and the Smith recording gas calorimeter.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING Co., East Pittsburgh, Pa., has issued leaflet 3461, which describes and illustrates its automatic current regulator for electric arc furnaces with movable electrodes. Schematic wiring diagrams and photographs of detailed parts of this apparatus are produced.

THE BUFFALO FORGE Co., Buffalo, N. Y., has published an attractive catalog, No. 460, on Buffalo Standard Heaters. The catalog has been prepared with the view of making it most useful to architects and engineers in figuring the heater requirement for fan heating and ventilating work. The tables

have been elaborated so as to include all the conditions usually met with in practice and to enable the user to read the values direct. To meet unusual conditions curves have been added which give values for various steam pressures and air velocities, and these enable any condition to be readily taken care of.

THE AMERICAN TOOL & MACHINE Co., Boston, Mass., has issued a catalog on Weston centrifugals for sugar-chemicals. Many illustrations and descriptive matter are given of the different types, together with a section on sprayers, dischargers, perforated linings and backings. There is also a very interesting write-up on scientific sugar washing. The booklet has been published in Spanish as well as in English.

THE ELECTRIC FURNACE Co., Alliance, O., is distributing Bull. 9-B, which illustrates and describes Bally electric furnaces for melting non-ferrous metals, also for heat treating and annealing.

THE LINK-BELT Co., Chicago, Ill., is now ready to distribute its 32-page book, No. 345, entitled "Link-Belt Silent Chain Drive for Cement Mill Equipment," which should be of advantage to engineers, superintendents and other officials of cement mills. This company has also published an engineering data book on the Link-Belt Roller Chain. This 78-page book, No. 257, shows photographs of roller chain drives operating motor trucks, tractors, cotton gins, industrial locomotives and other equipment. It is a handbook of value to power transmission engineers, and contains tables from which the proper size of chain and sprocket wheel can be selected to result in the best driving arrangement. This company also calls attention to the revised edition of catalog 380, which is now off the press and available for distribution. This 96-page book covers the Link-Belt line of standardized monorail electric hoists, as well as overhead electric traveling cranes in capacities of  $\frac{1}{2}$  to 3 tons inclusive. It completely describes these machines, giving tables of weights, clearance dimensions and speeds, together with illustrations, which include photographs of machines in operation.

ACHESON GRAPHITE Co., Niagara Falls, N. Y., announces a new publication on Brass Melting. This booklet presents information in regard to the electric melting of non-ferrous metals which is based upon statements by leading engineers of the industry and upon articles appearing in trade periodicals and the proceedings of technical societies. Short descriptions of various designs of arc and resistance furnaces have been contributed by the makers and are given in their own words.

BARBER-GREENE Co., Aurora, Ill., announces a new catalog, No. 4, on B-G Standardized Material Handling Machines, which consist of self-feeding bucket loaders, portable belt conveyors, and permanent belt conveyors for the handling of all kinds of bulk material. Many interesting illustrations are given, together with descriptive matter.

VIELE, BLACKWELL & BUCK, New York, has published Bull. 11, on Acids. This bulletin is an attempt to set up in convenient form descriptions of the acids which constitute a very large proportion of those commercially manufactured and exported, together with mention of a few of the principal uses of each of the acids in order to assist foreign purchasers in the development of business.

CUTLER-HAMMER MANUFACTURING Co., Milwaukee, Wis., has issued five new booklets on: The Value of Accurate Measurements of Gases and Air; Electric Heating of Water; Charging Equipment for Miner's Lamp Batteries; Metal Melting Pots; Battery Charging Equipment.

ARMSTRONG CORK & INSULATING Co., Pittsburgh, Pa., has published two booklets. "Armstrong's Cork Tile" gives illustrations and descriptions of tile suitable for banks, offices, libraries, museums, residences, stores, hotels, etc. The other booklet describes "Linotile Floors," suitable for offices, churches, banks, libraries, kitchens, pantries, theatres, stores, museums, elevators, sun rooms, etc. Many interesting illustrations are given in color, showing actual floors of Linotile. Anyone interested in flooring materials will be furnished copies upon request.

E. I. DU PONT DE NEMOURS & Co., Wilmington, Del., has published an attractive booklet on Dyestuff Intermediates.

NORTON Co., Worcester, Mass., has published a booklet on Snagging, which deals with the selection, care and use of snagging wheels.